



December 15, 2000

EXECUTIVE SUMMARY LETTER

TO: All Prospective Applicants

SUBJECT: Program Solicitation for Financial Assistance Applications for "Energy Efficient Building Equipment and Envelope Technologies, Round III," Program Solicitation Number DE-PS26-01NT41092

The purpose of this executive summary letter is to highlight some important elements of the Program Solicitation. This letter is not an integral part of the solicitation. The solicitation is a self-contained document. In the event of any conflict between the contents of this executive summary letter and the contents of the solicitation, the solicitation language will prevail.

It is the intent of the National Energy Technology Laboratory (NETL), on behalf of the Office of Building Technology, State, and Community Programs (BTS) in the U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy, to solicit the submission of innovative technologies that have the potential for significant energy savings in residential and commercial buildings. Through this solicitation, DOE is seeking to support projects that are advancing energy efficient building equipment, envelope and whole building technologies. Specifically, the objective of the solicitation is to accelerate high-payoff technologies that, because of their risk, are unlikely to be developed in a timely manner without a partnership between industry and the Federal government.

NETL intends to select a group of projects programmatically balanced with respect to: (1) technology category (equipment end uses, envelopes and whole buildings); (2) building type (residential and/or commercial); and (3) time of commercialization (short-term or long-term market potential of the technology). The solicitation will cover research and development on materials, components and systems applicable to both residential and commercial buildings. The solicitation will not support demonstration projects to deploy the technology on a large-scale but will support proof-of-concept projects.

The research and development areas of interest are as follows: Building Equipment -- energy conversion and control equipment supplying lighting, space conditioning (heating, cooling, dehumidification and ventilation), water heating, refrigeration, and appliance services to building occupants and commercial operations; Building Envelope -- materials, components and systems for the windows, walls, roofs, foundations, and other elements which comprise building exteriors and provide thermal integrity and day lighting; and Whole Buildings -- the integration of components

and systems in a systems engineering approach to govern overall energy use and indoor environmental quality in a building.

The solicitation covers research in four technology maturation stages. Technology Maturation Stage 2 involves applied research; Technology Maturation Stage 3 involves exploratory development (non-specific applications and bench-scale testing); Technology Maturation Stage 4 involves advanced development (specific applications and bench-scale testing); and Maturation Stage 5 involves engineering development (pilot-scale and/or field testing). For projects spanning more than one maturation stage, continuation decision points will be inserted at the completion of each stage. Additional decision points may be required depending upon the length of any one maturation stage; annual continuation decision points are preferred.

While it is DOE's intention to support development of products/systems that will culminate in successful completion of Maturation Stage 5, some needs are intended to obtain a better understanding of the science of energy and energy efficiency. In these cases, development of products/systems may not be feasible, and therefore may end prior to Maturation Stage 5. Applicants may address any combination or portion of the "need" areas described in the solicitation. While the Government desires a coordinated and interrelated approach, each proposed concept must be fully addressed separately (both technical and cost proposals) to facilitate the evaluation process. Should an applicant choose to integrate more than one concept, a separate discussion of the advantages to this approach must be provided.

Specifically, DOE is seeking to support the development of innovative technologies in the following "Need" areas:

NEED STATEMENT 1.0 WHOLE BUILDINGS

Traditionally buildings are designed and built by building disciplines (architects, engineers, contractors, consultants) working independently—resulting in buildings that are a collection of technologies (components, systems, and equipment) rather than an integrated whole. Through a whole building (or "systems engineering") approach, all of the building components and subsystems are considered together along with their potential interactions and impact on building occupants and building operating performance. The goal of this approach is to capitalize on opportunities to improve performance (such as energy or indoor environment) while mitigating or eliminating negative interactions among subsystems. The whole building approach can greatly improve energy and resource efficiency while improving the indoor environment, thus it is a key component in the developing field of high performance buildings.

1.1 Building Performance

The Road Map for Commercial Buildings identifies the need for core definitions and metrics for high-performance commercial buildings. There is a need to develop measurable, defensible and reproducible metrics for energy, economic, indoor environment, occupant

productivity, and other elements of whole-building performance. Such metrics will support marketing the positive benefits of high-performance buildings--replacing the largely anecdotal evidence available presently. In addition, a better understanding is needed of the fundamental physical processes that govern overall building performance as well as interaction of occupants and building systems. Physical processes include: 1) thermal, fluid, and mass flow, 2) indoor contaminant emissions including propagation and mitigation, and 3) component, equipment, and process interaction. One example of research work in this area would be the development, demonstration and validation of computer based modules to be incorporated into existing platforms such as EnergyPlus.

1.2 Controls

There is a need to develop technologies and intelligent systems that allow a building to monitor the status of its components, equipment, and systems and then optimally operate its energy-consuming systems. This includes development of low-cost solid-state wireless monitoring/communications for building performance throughout the building and “self-learning” building management systems with active operator guidance and training feedback. The goal of this task is to allow real-time monitoring and control of energy, indoor air quality, comfort, and pollutants after the building is commissioned.

NEED STATEMENT 2.0 LIGHTING TECHNOLOGY

Lighting in residential and commercial buildings accounts for 15% of the total energy used and 23% of the electricity consumed in the buildings sector. The potential exists to reduce lighting energy use by 50 percent by 2010 with new technology. To realize the potential, advances are needed in three areas: (1) advanced light source and ballast technologies; (2) luminaires, controls, and distribution systems; and (3) lighting impacts. These areas are also identified in the Lighting Road Map as key strategies and activities for achieving industry’s long-term vision for lighting.

2.1 Light Sources:

Lighting energy consumption can be significantly reduced by increasing the efficiency of light production. To increase efficiency, there is a need to advance the science and engineering of all types of light sources including incandescent, fluorescent, high-intensity discharge and solid state types. A better understanding is needed of the basic science of light production and of the physical processes that limit energy efficiency. Improvements in light source materials, processes, components, electronics, and systems are needed. Completely new light source technologies need to be established as viable, energy efficient, and cost effective alternatives to conventional technologies. One goal is to develop potential replacements for the inefficient incandescent lamp.

2.2 Luminaires, Controls, and Distribution Systems:

Opportunities exist to greatly reduce lighting energy consumption by delivering light more efficiently to end users and increasing the use of daylighting. Advances are needed in several areas, including: (1) luminaire materials and optics; (2) light collection, management, and distribution components and systems; and (3) advanced means for controlling delivered light in response to occupancy, daylight availability, and user needs. Opportunities also exist to integrate advanced lighting control technologies with other building systems such as HVAC, communications and security to reduce energy consumption.

2.3 Lighting Impacts:

Energy savings may also arise from optimizing the amount and type of delivered light for the purposes required. Optimizing delivered light is difficult since lighting impacts the way users interact with their environment in many complicated and little understood ways. Therefore, a more scientific understanding is needed of the relationship of light to human needs, especially the linkage between lighting characteristics and visual task performance and the likely impact of lighting on productivity and user acceptance.

NEED STATEMENT 3.0 SPACE CONDITIONING EQUIPMENT

The equipment and systems used to provide thermal comfort and adequate indoor air quality for residential and commercial buildings consumes 39% of the total energy used in buildings. Significant reductions in energy use can be achieved by increasing the efficiency of this equipment, by distributing thermal energy more efficiently and by more closely meeting the needs of building occupants.

3.1 Energy Conversion Efficiency:

While some types of heating and cooling equipment have improved significantly in terms of rated energy efficiency in the recent past, there is still a need for advanced materials, components and system designs to provide additional gains in rated efficiency. However, even the most highly energy efficient equipment frequently suffers from significant performance losses in the field from installation deficiencies, operational effects and long-term degradation. (For example, for unitary air-conditioners and heat pumps, performance losses in the field primarily arise from incorrect refrigerant charge, improper indoor air flow and overcapacity.) Research is needed to characterize these field performance losses and new technology is needed to minimize these losses and to facilitate proper installation, commissioning and performance monitoring for all types of equipment. There is also a need for improved technology for cost effectively controlling humidity and improving indoor air quality through ventilation or filtering while reducing overall energy consumption. There is a need for a greater understanding of the basic processes involved in energy conversion, heat

and mass transfer and other phenomena which influence space conditioning equipment efficiency and effectiveness.

3.2 Distribution, Storage, Control, and System Integration:

In contrast to energy conversion equipment, there has been less improvement in thermal energy distribution, storage and control systems in terms of energy efficiency and peak load reduction potential. For example, duct system designs, insulation materials and installation practices are a major source of system inefficiency nationally and often negate the benefits of high efficiency air-conditioning units. In many cases, systems operate most inefficiently during times of peak electric demand, thereby exacerbating electricity supply problems. Technology is needed to reduce losses in distribution systems, including an increase by a factor of 3 to 5 in insulation effectiveness in ducts contained in unconditioned spaces. Advancements are also needed to improve thermal storage systems, improve control systems, reduce system auxiliary and parasitic energy use and improve systems integration from a whole buildings perspective while meeting occupant comfort and performance requirements. Therefore, greater knowledge about the nature of energy losses and system interactions is needed, in addition to new components and systems, to reduce losses.

NEED STATEMENT 4.0 BUILDING ENVELOPE

Building envelopes consist of the windows, walls, roofs, foundations, and other elements which comprise building exteriors and/or enclose conditioned spaces. Building envelopes are the primary factor governing the heating, cooling, and ventilation requirements of buildings and also influence electric lighting requirements. Thus, building envelopes influence 53% of building energy use.

Substantial energy savings can be achieved through improvements in the materials, components, and systems which make up building envelopes. There is a need for improved envelope performance in terms of heat losses and gains, infiltration, moisture control, daylighting availability, etc., through advanced component technology, systems integration and an improved understanding of the basic processes governing envelope performance. There are opportunities for energy savings through integrating photovoltaic (PV) technology into building envelope components.

4.1 Building Materials and Envelope Systems:

Advanced insulation materials are needed to increase thermal performance, while satisfying constraints due to durability, cost, dimensional limits, and environmental, safety, and health concerns. Improved foundation, wall, and/or roof components or systems are also needed to cost effectively provide increased thermal performance, infiltration integrity, and moisture control and reduced environmental impact. Integrated PV-envelope components and systems are needed to reduce PV installed costs and improve the overall energy performance of buildings. A better understanding is needed of the basic heat and mass transfer processes governing the energy performance of envelope systems. For example, fundamental research

is needed on hygrothermal properties and the effects of moisture on thermal performance and durability of building materials. Development is needed of materials, including additives and coatings, that are both waterproof and breathable, resisting rain but allowing water vapor to escape for self-drying of the building envelope materials.

4.2 Windows:

Priorities for window and glazing technology needs are broadly addressed in the Window Road Map. Among these priorities, there is a need for advanced window systems and advanced glazing materials and deposition processes including material and process technologies for chromogenic and spectrally selective glazing. Examples of advanced window systems might include high thermal performance vacuum glazing, and low-cost retrofit technologies. There is a need for alternative chromogenic technologies with better properties and improved manufacturability compared to the electrochromic technologies now being developed. For spectrally selective glazing, new materials and advanced processing techniques are needed to improve deposition rates and to improve product optical and electrochemical properties, durability, and cost. In addition to advanced glazing technologies, new approaches are needed to accurately and economically measure the performance of high performance window products and components for controlling production quality, for evaluating units in inventory or in the field and for determining durability. There is a need for a public domain technology base on the durability of Insulating Glass units, which could support the development of durability performance standards. The Road Map further identifies the need to develop strategies and hardware necessary to optimize integration of the window with the rest of the building, potentially including thermal, light transmission, structural, power generation and data interconnections.

NEED STATEMENT 5.0 APPLIANCES

The appliances category consists of all energy using equipment not used for space conditioning, lighting or power generation in both residential and commercial buildings. A very wide variety of equipment is covered in this category (water heaters, refrigeration equipment, consumer and commercial cooking and laundry appliances, electronic equipment, etc.). Residential and commercial appliances consume approximately 28% of the energy used in buildings. Most types of equipment are partly covered by DOE's minimum efficiency standards. These standards have been a major factor in greatly increasing appliance efficiency in the residential sector. However, high efficiency product options are currently not available for some categories of residential appliances, commercial appliances are largely not covered by standards and standards do not apply to integrated appliances. New technologies are needed to cost-effectively attain efficiency levels well beyond current or proposed standards and to improve the energy efficiency of appliances not covered by minimum efficiency standards, particularly in the commercial sector. There is also an emerging technical opportunity in a need for energy-efficient "smart appliances" and appliance networking, in which appliances and other building equipment are interconnected or networked through data and control infrastructures to achieve energy savings, load management and user convenience benefits.

5.1 Water Heating:

Water heating accounts for 12% of the total energy consumed in buildings. Currently, the average efficiency of water heating is relatively low compared to thermodynamic limits. Therefore, there is considerable opportunity to reduce energy use overall in the buildings sector by improving the efficiency of water heating and/or hot water delivery system efficiency. Advances are needed in cost-effective components and system designs for both single-purpose water heaters and multi-purpose, integrated water heating systems using both fossil fuels and electricity for residential and commercial applications. Specifically, there is a need to develop technology for cost-effective electric heat pump water heaters appropriate for widespread use. There is also a need to develop fail safe, cost-effective technology that will reduce the standby losses and/or increase the recovery efficiency of gas or oil-fired residential water heaters. There is also a need to develop a low-cost, high-R insulation for all types of residential and commercial water heaters.

5.2 Commercial Refrigeration:

Commercial refrigeration consists of a wide variety of equipment ranging from stand-alone, self-contained vending machines to large supermarket systems consisting of multiple display cases and walk-in units using remote parallel compressors and condensers. This type of equipment accounts for 3% of the total energy consumed in buildings. Energy efficiency standards or energy labeling generally does not exist for these products. In addition, new FDA requirements for keeping food temperature at a safe level, especially for refrigerated meat products, is expected to increase energy use over the current levels. There is a need to develop and demonstrate component and control technologies and new designs for merchandising units (e.g., supermarket display cases) that result in a significant reduction in energy use while meeting product temperature limits with no impact on merchandising effectiveness.

5.3 Other Appliances:

Major advancements are needed in component technologies, particularly those which apply to a wide variety of product types. For example, advanced appliance insulation materials are needed to increase appliance thermal performance, while satisfying constraints such as durability, cost, user acceptance, size limits, and environmental, safety, and health concerns. There is a need also to accelerate the development of innovative system designs, improved controls and integrated or networked appliances, particularly for appliance categories not covered by minimum efficiency standards and those for which high efficiency product alternatives do not exist. Example product categories include advanced clothes dryers, electronic equipment (computers, office equipment, telecommunications, etc.) and commercial appliances in general.

Individuals, corporations, nonprofit organizations, small and small disadvantaged businesses, educational institutions, and state or local governments or other entities who wish to have an application evaluated should respond to the requirements of this solicitation. Applicants must propose a Statement of Project Objectives which describes the proposed effort that will meet the Government's objectives. A sample Statement of Project Objectives format is presented in the attached solicitation. Specific details and objectives for the research and development program are set forth in the solicitation objectives (see Section VIII, Appendix B).

The solicitation is structured as follows:

Sample Cooperative Agreement consisting of the following four sections:

Section I -- Notice of Financial Assistance Award (DOE F 4600.1#)

Section II -- Special Terms and Conditions

Section III -- Intellectual Property Provisions

Section IV -- List of Attachments.

Section V -- Conditions and Notices

Section VI -- Evaluation Criteria and Program Policy Factors.

Section VII -- Appendix A -- Business and Financial Preparation Instructions.

Section VIII -- Appendix B -- Technical Application Preparation Instructions.

Section IX -- Appendix C -- Guide for Evaluation of Energy Savings Potential.

The Government anticipates multiple awards regardless of the technology maturation stage proposed, with continuation decision points occurring at the completion of each technology maturation stage, or annually if a maturation stage's schedule exceeds 12-months. DOE intends to award cooperative agreements, but reserves the right to award whatever instrument is in the Government's best interest.

The intent of this solicitation is to promote commercialization of energy efficient technologies. Therefore, an organization that does not qualify for the statutory patent waiver granted to domestic small businesses and non-profit organizations may apply for an individual advance patent waiver, in which the standard DOE waiver process will be followed. The conditions for a patent waiver are a minimum of 20% cost share and agreement to accept the clause titled "Patent Rights--Waiver," which will be incorporated into the cooperative agreement. This clause sets forth the terms and conditions under which the recipient may elect to retain title to subject inventions under the cooperative agreement.

There is no prohibition against foreign entities participating as prime recipients or subcontractors. However, it should be noted that certain requirements (i.e. Section 2306 of the Energy Policy Act, 42 U.S.C. 13525) are applicable to foreign entities that are not applicable to U.S.-owned entities.

Per Sections 3001 and 3002 of the Energy Policy Act (EPAct) 42 U.S.C. 13542 for financial assistance awards, applicants are advised that this solicitation contains a 20% cost share requirement

on the part of the recipient, as a percent of the total award value, not as a percent of the Government's share. If during the preliminary application review it is found that the applicant does not satisfy the cost-sharing requirement as set forth in the solicitation, the application may not be comprehensively reviewed, and, thus, may not be considered for an award.

The total DOE amount available for this federal assistance solicitation in FY 2001 is approximately \$7,000,000. The anticipated DOE balance of \$9,000,000 is contingent upon the availability of appropriated FY 2002 and FY 2003 funds. It is anticipated that individual awards for the entire project will generally range between \$200,000 and \$2,000,000. The duration of these projects is expected to range between 10-months and 3-years.

Please be advised that non-Federal personnel may be used in the evaluation of applications for this particular solicitation. A nondisclosure agreement will be signed by all Federal and non-Federal evaluators and advisors prior to DOE furnishing a copy of the application(s) to the evaluators or advisors, along with instructions on the proper care regarding the handling of the application(s).

The Government does not anticipate providing any facilities or property for accomplishing this effort. Applicants are encouraged to propose utilization of existing facilities and make allowances for providing all necessary personnel, facilities, special test equipment, and materials to complete proposed project(s).

Applications must be submitted in accordance with the requirements of the solicitation. Each of the required application parts should be bound separately and clearly labeled. The applications must be received by the Contract Specialist not later than 4:00 p.m. local prevailing time on **February 9, 2001**, at the address below:

U.S. Department of Energy
National Energy Technology Laboratory
ATTN: John R. Columbia
626 Cochrans Mill Road
MS 921-107
Pittsburgh, PA 15236

Selection is expected to be made in June 2001 and the cooperative agreements awarded in July 2001. Therefore, applications must authorize a period for acceptance by the Government of not less than one hundred eighty (180) calendar days from the date specified for receipt of applications. Furthermore, you are cautioned that late applications, modifications, revisions, and withdrawals will be treated in accordance with Section V, Article 5.18 of the solicitation.

Applications submitted by, or on behalf of: (1) another Federal agency; (2) a FFRDC sponsored by another Federal agency; or (3) a DOE M&O contractor will not be eligible for an award under this solicitation. Applicants are encouraged to maximize the use of private sector organizations in the performance of the proposed work. However, an application that includes performance of a portion

of the work by a FFRDC or DOE M&O contractor will be evaluated and may be considered for award, provided that: 1) the proposed use of any such entity is specifically authorized in writing by the cognizant agency for the FFRDC or responsible DOE Contracting Officer for the M&O contractor, or authorized designee; 2) the proposed work is consistent with or complementary to agency or DOE missions and the missions of the facility to which the work is to be assigned; 3) the proposed work will not adversely impact execution of assigned programs of the facility; 4) the proposed work will not place the facility in direct competition with the domestic private sector; 5) the proposed work will not create a detrimental future burden on DOE resources; and 6) the amount of work to be performed by the FFRDC or DOE M&O contractor may not be greater than the aggregate amount of work to be performed by all other participants in the project [unless a higher level of participation is determined to be in the best interests of the Government in advancing the objectives of the solicitation]. DOE will review the application to determine that it meets these criteria and reserves the right to reject any application that fails to do so. DOE reserves the right to fund the work through a subcontract, an interagency agreement or a DOE field work proposal.”

All requests for explanation or interpretation of any part of the solicitation shall be submitted in writing to the Contract Specialist at the aforementioned address or via e-mail to columbia@netl.doe.gov. To allow a reply to reach all prospective applicants before the submission of their applications, your written questions must be received by the Contract Specialist no later than January 26, 2001. If the Government elects to answer the questions, the questions will be answered, without reference to the originating source, via an associated file to the solicitation entitled, “Questions and Answers” posted along with the solicitation and any applicable amendments on the NETL’s Internet URL at {<http://www.netl.doe.gov/business/solicit>}. For prospective applicant’s who obtained a copy of the solicitation via NETL’s Internet URL, please check this location frequently for any amendments. The Government reserves the right not to respond to questions received after January 26, 2001, nor respond to questions submitted by telephone or in person at any time.

It is recommended that all prospective applicants download a copy of the DOE “Lobbying Brochure” (<http://www.pr.doe.gov/lobbying.html>) which provides a summary of the statutory and regulatory restrictions regarding lobbying activities for Federal contractors and recipients.

Please note that an automated document writing system has been used to prepare this document. Each provision in the data base has been assigned a number. Not all of the provisions in the data base have been used in this document; therefore, the numbering may not be continuous. Blank areas appearing in the solicitation, indicated by “[TBD]” or “[To Be Determined]” will be completed after negotiations.

All debriefings of applications will be conducted in writing at the earliest feasible time.

Opportunity to Comment:

DOE has a Financial Assistance Internet web site where the public can obtain information related to grants and cooperative agreements. The web site, at <http://www.pr.doe.gov/fahome.html>, highlights an “Opportunity to Comment” on the current financial assistance program simplification effort. Comments should be provided via E-mail to: PL106107@pr.doe.gov. All comments will be reviewed, analyzed, and summarized for use by DOE and the various interagency work groups involved with implementation of the law.

The Opportunity to Comment includes identifying those processes in the financial assistance life cycle that need streamlining or improvement and offering suggestions for achieving improvements. It asks the recipient community 1) to describe what is most important in terms of program simplification; 2) to identify the specific financial assistance programs found to be most burdensome, and 3) to provide details about why they are burdensome. DOE will consider all responses in its simplification effort and provide summaries to the interagency working groups.

The input is valued, and is part of the larger process of achieving the goals the Department and of P.L. 106-107, namely simplification of Federal financial assistance programs for the benefit of our recipients.

All communications concerning this solicitation should cite the Program Solicitation number and be directed in writing to the attention of the Contract Specialist via mail at the letterhead address or via E-mail at columbia@netl.doe.gov.

Sincerely,

Original Signed By

John R. Columbia
Contract Specialist
Acquisition and Assistance Division

Enclosure

U.S. DEPARTMENT OF ENERGY
NOTICE OF FINANCIAL ASSISTANCE AWARD
(See Instructions on Reverse)

Under the authority of Public Law Federal Grant and Cooperative Agreement Act, Public Law 97-224 as amended by Public Law 97-258 (U.S.C. 6301-6308) and DOE Organization Act, Public Law 95-91 _____ and subject to

legislation,
 regulations and policies applicable to (cite legislative program title):

1. PROJECT TITLE Energy Efficient Building Equipment and Envelope Technologies	2. INSTRUMENT TYPE <input type="checkbox"/> GRANT <input checked="" type="checkbox"/> COOPERATIVE AGREEMENT					
3. RECIPIENT (Name, address, zip code, area code and telephone no.)	4. INSTRUMENT NO. DE-FC26-01NT41092	5. AMENDMENT NO. A000				
	6. BUDGET PERIOD FROM: THRU:	7. PROJECT PERIOD FROM: THRU:				
8. RECIPIENT PROJECT DIRECTOR (Name and telephone no.)	10. TYPE OF AWARD <input checked="" type="checkbox"/> NEW <input type="checkbox"/> CONTINUATION <input type="checkbox"/> RENEWAL <input type="checkbox"/> REVISION <input type="checkbox"/> SUPPLEMENT					
9. RECIPIENT BUSINESS OFFICER (Name and telephone no.)						
11. DOE PROJECT OFFICER (Name, address, zip code, telephone no.)	12. ADMINISTERED FOR DOE BY (Name, address, zip code, telephone no.)					
13. RECIPIENT TYPE <input type="checkbox"/> STATE GOV'T <input type="checkbox"/> INDIAN TRIBAL GOV'T <input type="checkbox"/> HOSPITAL <input type="checkbox"/> FOR PROFIT ORGANIZATION <input type="checkbox"/> INDIVIDUAL <input type="checkbox"/> LOCAL GOV'T <input type="checkbox"/> INSTITUTION OF HIGHER EDUCATION <input type="checkbox"/> OTHER NONPROFIT ORGANIZATION <input type="checkbox"/> C <input type="checkbox"/> P <input type="checkbox"/> SP <input type="checkbox"/> OTHER (Specify)						
14. ACCOUNTING AND APPROPRIATIONS DATA: <table style="width: 100%; border: none;"> <tr> <td style="border: none;">a. Appropriation Symbol</td> <td style="border: none;">b. B&R Number</td> <td style="border: none;">c. FT/AFP/OC</td> <td style="border: none;">d. CFA Number</td> </tr> </table>		a. Appropriation Symbol	b. B&R Number	c. FT/AFP/OC	d. CFA Number	15. EMPLOYER I.D. NUMBER/SSN
a. Appropriation Symbol	b. B&R Number	c. FT/AFP/OC	d. CFA Number			
16. BUDGET AND FUNDING INFORMATION <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> a. CURRENT BUDGET PERIOD INFORMATION (1) DOE Funds Obligated This Action \$ _____ (2) DOE Funds Authorized for Carry Over \$ _____ (3) DOE Funds Previously Obligated in this Budget Period \$ _____ (4) DOE Share of Total Approved Budget \$ _____ (5) Recipient Share of Total Approval Budget \$ _____ (6) Total Approved Budget \$ _____ </td> <td style="width: 50%; border: none;"> b. CUMULATIVE DOE OBLIGATIONS (1) This Budget Period \$ _____ [Total of lines a.(1) and a.(3)] (2) Prior Budget Periods \$ _____ (3) Project Period to Date \$ _____ [Total of lines b.(1) and b.(2)] </td> </tr> </table>			a. CURRENT BUDGET PERIOD INFORMATION (1) DOE Funds Obligated This Action \$ _____ (2) DOE Funds Authorized for Carry Over \$ _____ (3) DOE Funds Previously Obligated in this Budget Period \$ _____ (4) DOE Share of Total Approved Budget \$ _____ (5) Recipient Share of Total Approval Budget \$ _____ (6) Total Approved Budget \$ _____	b. CUMULATIVE DOE OBLIGATIONS (1) This Budget Period \$ _____ [Total of lines a.(1) and a.(3)] (2) Prior Budget Periods \$ _____ (3) Project Period to Date \$ _____ [Total of lines b.(1) and b.(2)]		
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17. TOTAL ESTIMATED COST OF PROJECT \$ _____ <i>(This is the current estimated cost of the project. It is not a promise to award nor an authorization to expend funds in this amount.)</i>						
18. AWARD AGREEMENT TERMS AND CONDITIONS This award/agreement consists of this form plus the following: a. Special terms and conditions (if granted) or schedule, provisions, special concerns (if cooperative agreement). b. Applicable program regulations (specify) _____ (Date) _____ c. DOE Assistance Regulations, 10 CFR Part-600, as amended, Subparts A and <input type="checkbox"/> B (Grants) or <input checked="" type="checkbox"/> C (Cooperative Agreements). d. Application/proposal dated _____, <input type="checkbox"/> as submitted <input type="checkbox"/> with changes as negotiated.						
19. REMARKS						
20. EVIDENCE OF RECIPIENT ACCEPTANCE _____ <i>(Signature of Authorized Recipient Official)</i> <i>(Date)</i> _____ <i>(Name)</i> _____ <i>(Title)</i>	21. AWARDED BY _____ <i>(Signature)</i> <i>(Date)</i> _____ <i>(Name)</i> _____ <i>Contracting Officer</i> <i>(Title)</i>					

SECTION II -- SPECIAL TERMS AND CONDITIONS

2.1 CONSECUTIVE NUMBERING (JAN 1999)

Due to automated procedures employed in formulating this document, clauses and provisions within it may not always be continuously numbered.

2.2 PREVAILING REGULATIONS (NOV 1998)

As indicated on the face page, Block 18c, this Award is subject to the DOE Assistance Regulations of Title 10, Code of Federal Regulations, Part 600. This set of regulations may be found in most major libraries or on the World Wide Web at:

<http://www.pr.doe.gov/fahome.html>

2.3 ORDER OF PRECEDENCE (DEC 1999)

In the event of any inconsistency among the provisions of this agreement, the inconsistency shall be resolved by giving precedence as follows: (a) Applicable Public Laws; (b) the special terms and conditions or schedule of articles; © 10 CFR Part 600; and (d) other documents, exhibits and attachments.

2.4 SUBSTANTIAL INVOLVEMENT BETWEEN DOE AND THE RECIPIENT (JAN 1999)

There will be substantial involvement between the DOE and the Recipient during performance of this Cooperative Agreement.

The following type of activity is generally viewed as substantial involvement.

-- Review and approval during the project period of one stage before work can begin on a subsequent stage in sharing of the responsibility for the direction of the project. (i.e. The DOE will participate in establishing and approving a work plan, which will identify essential and significant milestones necessary for completion of the project. This work plan will be used to determine whether or not to proceed with subsequent tasks of the Statement of Project Objectives.)

2.5 COST SHARING (JULY 2000)

The total estimated cost of the project for the work to be accomplished under this award is [\$TBD]. The Recipient and the Government agree to share the allowable project costs under this award as follows:

DOE:	[TBD]%
Recipient:	[TBD]%
Total:	100%

2.6 FUNDING (SEP 2000)

This award is to be incrementally funded. The DOE has currently obligated \$[TBD] and anticipates, subject to the availability of additional funds, obligating the DOE balance of \$[TBD]. The Recipient shall not be obligated to continue performance of this project beyond the amount set forth in Block 16(b)(3) of the DOE F 4600.1 and the DOE is under no commitment to provide additional funding to the Recipient beyond this amount.

2.7 ALLOWABLE PREAWARD COSTS (MAR 1999)

The Recipient is entitled to reimbursement of preaward costs in the amount not to exceed [TBD] of DOE obligations. These costs are limited to work associated with performance of [TBD], incurred during the period starting on [TBD] through the effective start date of this award (Block 7, DOE F 4600.1).

2.8 CONTINUATION APPLICATION (DEC 1999)

Funding for each budget period within the approved project period shall be contingent on DOE approval of a continuation application submitted no later than 60 days prior to the end of the current budget period. The continuation application shall be submitted on the SF 424 in accordance with 10 CFR 600.26. Forms for submission of continuation applications can be found at <http://www.netl.doe.gov/business/forms/forms.html>.

2.9 METHOD OF PAYMENT (NOV 2000)

The method of payment to the Recipient shall be accomplished by the method checked below:

- ☐ Advance in accordance with 10 CFR 600.122(b)
- ☐ Reimbursement in accordance with 10 CFR 600.122(e)
- ☐ Other in accordance with 10 CFR 600.122

The Recipient shall request advances or reimbursements using the Standard Form SF 270, Request for Advance or Reimbursement, and shall complete Blocks 1-11 and 13. Electronic versions of the SF 270 can be found on the NETL website at: <http://www.netl.doe.gov/business/forms/forms.html>

Note 1: If the block designating payment by Advance is used, the Recipient is allowed advances not to exceed the funding required to cover expenditures for any succeeding one month time period. Such requests for monthly advances shall be prepared using the Standard Form SF 270 in an original and two (2) copies.

The original is to be submitted to:

U. S. Department of Energy
Oak Ridge Financial Services
P. O. Box 4787
Oak Ridge, TN 37831

The two copies are to be submitted to:

U. S. Department of Energy
National Energy Technology Laboratory
Commercial Payments Center
P. O. Box 10940, MS 921-107
Pittsburgh, PA 15236-0940

Note 2: If the block designating payment by Reimbursement is used, the Recipient shall submit the request for payment for costs incurred using the Standard Form SF 270 in an original and two (2) copies as indicated in Note 1 above. This request shall not be submitted more frequently than monthly.

STATUS OF PAYMENTS

The Oak Ridge Financial Service Center (ORFSC) has a system via Internet, in which Recipients can request information about payments by invoice, by award number, and/or by paid date. The system is called Vendor Inquiry Payment Electronic Reporting System (VIPERS) and is available to Recipients at the following website: <http://finweb.oro.doe.gov/vipers.htm>. Recipients must have a federal tax identification number (TIN) and then obtain a personal identification number (PIN) to access the system.

2.10 NOTICE OF INVOICE PROCESSING BY SUPPORT CONTRACTOR (DEC 1999)

A support service contractor performs the function of processing of all invoices submitted to the National Energy Technology Laboratory, against its awards. Therefore, this contractor has access to your business confidential cost/rate information. A special provision in this contractor's award requires the confidential treatment by all contractor employees of any and all business confidential information of other contractors and financial assistance recipients to which they have access.

2.11 ACKNOWLEDGMENT OF FEDERAL FUNDING (NOV 1998)

When issuing statements, press releases, requests for proposals, bid solicitations, and other documents describing this project, the Recipient shall clearly state (1) the percentage of the total cost of the project which will be financed with Federal money, and (2) the dollar amount of Federal funds for the project.

2.12 REAL PROPERTY - NONE (JAN 1999)

No real property may be acquired under this award.

2.13 RECIPIENT ACQUIRED PROPERTY (MAY 1999)

Reference Attachment D for a listing of property authorized for acquisition under this award. Property acquired by the Recipient under this award shall be managed in accordance with 10 CFR 600.130 to 10 CFR 600.137, and reported as prescribed in Attachment B, Federal Assistance Reporting Checklist.

2.14 FEDERALLY OWNED PROPERTY (GOVERNMENT-FURNISHED) - NONE (JAN 1999)

No Government-furnished property is provided under this award.

2.15 KEY PERSONNEL (JUN 2000)

Recipient personnel considered to be essential and key to the work being performed hereunder are specified below.

<u>NAME</u>	<u>TITLE</u>	<u>TELEPHONE</u>
[TBD]	[TBD]	[TBD]

The personnel specified in this clause are considered to be essential to the project. Before diverting any key personnel to work outside the scope of this award, the Recipient shall notify the Contracting Officer reasonably in advance and shall submit justification (including proposed substitutions) in sufficient detail to permit evaluation of the impact on the project. No key personnel may be substituted without the Contracting Officer's approval. Such approval shall be obtained in advance of the substitution, except that the Contracting Officer may ratify a

substitution which, because of exigent circumstances, was made before the Recipient could request and/or obtain the Contracting Officer's approval.

2.16 PAPERWORK REDUCTION (NOV 1998)

The award is subject to the requirements of the Paperwork Reduction Act of 1980 as implemented by the Office of Management and Budget rules, "Controlling Paperwork Burdens on the Public," published at 5 CFR 1320. These requirements apply if the Recipient will collect information from ten (10) or more respondents at the specific request of DOE, or if the award requires specific DOE approval of the information collection or the collection procedures.

The Recipient shall submit any proposed sponsored information collection to the person identified on the DOE F 4600.1 (Award Face Page, Block 12). The proposal shall be submitted at least 120 days prior to the intended date of information collection. DOE will seek the requisite approval from the Office of Management and Budget (OMB) and will promptly notify the Recipient of the disposition of the request.

2.17 PUBLIC ACCESS TO INFORMATION (APR 2000)

The Freedom of Information Act, as amended, and the DOE implementing regulations (10 CFR 1004) require DOE to release certain documents and records regarding awards to any person who provides a written request. The intended use of the information will not be a criterion for release.

2.18 NATIONAL SECURITY (NOV 1998)

It is not expected that activities under the award will generate or otherwise involve classified information (i.e., Restricted Data, Formerly Restricted Data, National Security Information).

However, if in the opinion of the Recipient or DOE such involvement becomes expected prior to the closeout of the award, the Recipient or DOE shall notify the other in writing immediately. If the Recipient believes any information developed or acquired may be classifiable, the Recipient shall not provide the potentially classifiable information to anyone, including the DOE officials with whom the Recipient normally communicates, except the Director of Classification, and shall protect such information as if it were classified until notified by DOE that a determination has been made that it does not require such handling. Correspondence which includes the specific information in question shall be sent by registered mail to U. S. Department of Energy, Attn.: Executive Assistant for Defense Programs, DP-4, 4A-019/FORS, 1000 Independence Avenue, Washington, D.C. 20585. If the information is determined to be classified, the Recipient may wish to discontinue the project, in which case the Recipient and DOE shall terminate the award by mutual agreement. If the award is to be terminated, all materials deemed by DOE to be classified shall be forwarded to DOE, in a manner specified by DOE, for proper disposition. If the Recipient and DOE wish to continue the award, even though classified information is involved, the Recipient shall be required to obtain both personnel and facility security clearances through the Office of Safeguards and Security for Headquarters awarded awards obtained through DOE field organizations. Costs associated with handling and protecting any such classified information shall be negotiated at the time the determination to proceed is made.

2.19 COMPLIANCE WITH BUY AMERICAN ACT (DEC 1999)

In accepting this award, the Recipient agrees to comply with sections 2 through 4 of the Act of March 3, 1933 (41 U.S.C. 10a-10c, popularly known as the "Buy American Act"). The

Recipient should review the provisions of the Act to ensure that expenditures made under this award are in accordance with it.

2.20 NOTICE REGARDING THE PURCHASE OF AMERICAN-MADE EQUIPMENT AND PRODUCTS -- SENSE OF CONGRESS (DEC 1999)

It is the sense of the Congress, that to the greatest extent practicable, all equipment and products purchased with funds made available under this award should be American-made.

2.21 LOBBYING RESTRICTION (DEPARTMENT OF INTERIOR AND RELATED AGENCIES APPROPRIATIONS ACT, 2000) (DEC 1999)

The awardee agrees that none of the funds obligated on this award shall be made available for any activity or the publication or distribution of literature that in any way tends to promote public support or opposition to any legislative proposal on which Congressional action is not complete. This restriction is in addition to those prescribed elsewhere in statute and regulation.

A copy of the DOE "Lobbying Brochure" which provides a summary of the statutory and regulatory restrictions regarding lobbying activities for Federal contractors can be found at (<http://www.pr.doe.gov/lobbying.html>).

2.22 NOTICE REGARDING UNALLOWABLE COSTS AND LOBBYING ACTIVITIES (NOV 1998)

Recipients of financial assistance are cautioned to carefully review the allowable cost and other provisions applicable to expenditures under their particular award instruments. If financial assistance funds are spent for purposes or in amounts inconsistent with the allowable cost or any other provisions governing expenditures in an award instrument, the government may pursue a number of remedies against the Recipient, including in appropriate circumstances, recovery of such funds, termination of the award, suspension or debarment of the Recipient from future awards, and criminal prosecution for false statements.

Particular care should be taken by the Recipient to comply with the provisions prohibiting the expenditure of funds for lobbying and related activities. Financial assistance awards may be used to describe and promote the understanding of scientific and technical aspects of specific energy technologies, but not to encourage or support political activities such as the collection and dissemination of information related to potential, planned or pending legislation.

2.23 YEAR 2000 COMPLIANCE (NOV 1998)

Year 2000 compliant means, with respect to information technology, the information technology accurately processes date/time data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, and the years 1999 and 2000 and leap year calculations, to the extent that other information technology, used in combination with the information technology being acquired, properly exchanges date/time data with it.

The Recipient assures, by acceptance of this award, that items delivered under this contract are year 2000 compliant.

2.24 REPORTING (NOV 1998)

Failure to comply with the reporting requirements contained in this award will be considered a material noncompliance with the terms of the award. Noncompliance may result in a withholding of future payments, suspension or termination of the current award, and withholding of future awards. A willful failure to perform, or of unsatisfactory performance of this and/or

other financial assistance awards, may also result in a debarment action to preclude future awards by Federal agencies.

2.25 RESEARCH INVOLVING RECOMBINANT DNA MOLECULES (NOV 1998)

Any Recipient performing research involving recombinant DNA molecules and/or organisms and viruses containing recombinant DNA molecules agrees by acceptance of this award to comply with the National Institute of Health "Guidelines for Research Involving Recombinant DNA Molecules," (59 FR 34496, July 5, 1994 as amended by 59 FR 40170, 60 FR 20726, 61 FR 1482, 61 FR 10004, 62 FR 53335, 62 FR 56196, 62 FR 59032 and 63 FR 8052, "subject to change - call 301-496-9838 to obtain reference to a current version.")

2.26 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) -- PRIOR APPROVALS (DEC 1999)

The National Environmental Policy Act of 1969 (NEPA) requires that all Federal agencies consider the impacts of their projects on the human environment. As part of the DOE's NEPA requirements, the Recipient shall be required to supply to the DOE certain environmental information. DOE funds may only be expended by the Recipient on [INSERT ACTIVITIES THAT CAN BE PERFORMED UNTIL THE NEPA DOCUMENT IS SIGNED, i.e., preliminary designs or drawings] activities, or in a manner inconsistent with 10 CFR 1506.1, until DOE notifies the Recipient that all NEPA requirements have been satisfied.

2.27 SAFETY & HEALTH AND ENVIRONMENTAL PROTECTION (JAN 1999)

The Recipient shall implement the DOE work in accordance with all applicable Federal, State, and local laws, including codes, ordinances, and regulations, covering safety, health, and environmental protection.

The Recipient agrees to include this clause in first-tier subcontracts and agrees to enforce the terms of this clause.

2.28 PERMITS AND LICENSES (AUG 1999)

Within sixty (60) days of award, the Recipient shall submit to the DOE Contracting Officer Representative (COR) a list of ES&H approvals that, in the Recipient's opinion, shall be required to complete the work under this award. The list shall include the topic of the approval being sought, the approving authority, and the expected submittal/approval schedule. The COR shall be notified as specific items are added or removed from the list and processed through their approval cycles.

The Recipient agrees to include this clause in first-tier subcontracts and agrees to enforce the terms of this clause.

SECTION III -- INTELLECTUAL PROPERTY PROVISIONS

3.1 INTELLECTUAL PROPERTY PROVISIONS (JAN 1999)

The patent and technical data clauses included in this section apply to this award. As used in these applicable clauses, the term "Patent Counsel" refers to the following point of contact:

Intellectual Property Law Division
U.S. Department of Energy
Chicago Operations Office
9800 South Cass Avenue
Argonne, IL 60439

In any of the FAR and DEAR clauses contained in this section, use of the term "Contract" means "Award" and "Contractor" means "Recipient."

The Recipient shall include intellectual property clauses in any contract awarded in accordance with requirements of the clauses in this section and of 10 CFR Part 600.27.

3.2 PUBLICATION OF RESULTS/ACKNOWLEDGMENT STATEMENT (JAN 1999)

Publication of the results of the award is encouraged subject to any applicable restrictions in 10 CFR 600.27 (Patent and Data Provisions). Publications, as well as reports prepared under this award shall contain the following acknowledgment statement:

"This (describe material) was prepared with the support of the U.S. Department of Energy, under Award No. DE-[TBD]. However, any opinions, findings, conclusions, or recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of the DOE".

3.3 RECIPIENT PRESS RELEASES (APR 1998)

The DOE policy and procedure on planned press releases requires that all Recipient press releases be reviewed and approved by DOE prior to issuance. Therefore, the Recipient shall, at least ten (10) days prior to the planned issue date, submit a draft copy to the Contracting Officer of any planned press releases related to work performed under this award. The Contracting Officer will then obtain necessary reviews and clearances and provide the Recipient with the results of such reviews prior to the planned issue date.

3.4 CONFIDENTIAL BUSINESS INFORMATION (DEC 1999)

Data represented to the Department as being confidential business information, and which does not include "Technical Data" as that term is defined in 52.227-14 Rights in Data General clause of this agreement, shall be submitted as an attachment to the required reports and will be withheld from disclosure outside NETL to the extent permitted by law, provided such attachment and each page therein is stamped with the following legend and no other:

CONFIDENTIAL BUSINESS INFORMATION

The Recipient considers the data furnished herein to contain confidential business information which is to be withheld from disclosure outside NETL to the extent permitted by law.

3.5 CLAUSES INCORPORATED BY REFERENCE (AUG 1999)

This solicitation incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es):

Federal Acquisition Regulations (FAR) (Clauses starting with 52):

<http://www.arnet.gov/far/index.html>

Department of Energy Acquisition Regulations (DEAR) (Clauses starting with 952)

<http://www.pr.doe.gov/dear.html>

**3.6 52.227-1 AUTHORIZATION AND CONSENT. (JUL 1995) -- ALTERNATE I
APR 1984**

**3.7 52.227-2 NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHT
INFRINGEMENT. AUG 1996**

**3.8 952.227-11 PATENT RIGHTS-RETENTION BY THE CONTRACTOR (SHORT FORM).
FEB 1995**

**3.9 952.227-13 PATENT RIGHTS-ACQUISITION BY THE GOVERNMENT.
SEP 1997**

**3.10 FAR 52.227-14 RIGHTS IN DATA -GENERAL. (JUN 1987) WITH ALTERNATE V (JUN
1987) AS AMENDED BY DEAR 927.409 JAN 1999**

3.11 52.227-16 ADDITIONAL DATA REQUIREMENTS. JUN 1987

3.12 52.227-23 RIGHTS TO PROPOSAL DATA (TECHNICAL). JUN 1987

Except for data contained on pages [], it is agreed that as a condition of award of this contract, and notwithstanding the conditions of any notice appearing thereon, the Government shall have unlimited rights (as defined in the "Rights in Data - General" clause contained in this contract) in and to the technical data contained in the proposal dated [], upon which this contract is based.

SECTION IV -- LIST OF ATTACHMENTS

4.1 LIST OF ATTACHMENTS (JAN 1999)

Attachment A -- Statement of Project Objectives

Attachment B -- Federal Assistance Reporting Checklist

Attachment C -- Budget Page(s)

Attachment D -- Recipient Acquired Property

4.2 ATTACHMENT A -- STATEMENT OF PROJECT OBJECTIVES - UNDEFINED (AUG 1999)

The Statement of Project Objectives will be inserted on this page upon award.

The applicant must prepare the Statement of Project Objectives and include it as an Appendix to Volume II - Technical Application. Instructions for preparation of this document can be found in Section VIII.

FEDERAL ASSISTANCE REPORTING CHECKLIST

1. Awardee:	2. Identification Number:																																																
3. Report Submission Address: <i>The requested quantity of all required report deliverables shall be submitted to the following address:</i> <div style="text-align: center;"> NETL A&D Document Control U.S. Department of Energy National Energy Technology Laboratory P.O. Box 10940, MS 921-107 Pittsburgh, PA 15236-0940 </div>																																																	
4. Planning and Reporting Requirements:																																																	
A. PROGRAM/PROJECT MANAGEMENT <input checked="" type="checkbox"/> Federal Assistance Milestone Plan <input checked="" type="checkbox"/> Milestone Log <input checked="" type="checkbox"/> Federal Assistance Management Summary Report <input checked="" type="checkbox"/> Federal Assistance Program/Project Status Report <input checked="" type="checkbox"/> Financial Status Report <input type="checkbox"/> Federal Cash Transaction Report B. TECHNICAL (One paper copy and one PDF electronic file copy) <input checked="" type="checkbox"/> Technical Progress Report <input checked="" type="checkbox"/> Topical Report <input checked="" type="checkbox"/> Final Report C. ENVIRONMENTAL <input checked="" type="checkbox"/> Hazardous Substance Plan <input checked="" type="checkbox"/> Hazardous Waste Report <input type="checkbox"/> Environmental Compliance Plan <input type="checkbox"/> Environmental Monitoring Plan <input type="checkbox"/> Environmental Status Report D. PROPERTY <input checked="" type="checkbox"/> Annual Report of Property in the Custody of Contractors <input type="checkbox"/> High Risk Property Report <input checked="" type="checkbox"/> Report of Termination or Completion Inventory E. EXCEPTION <input type="checkbox"/> Conference Record <input checked="" type="checkbox"/> Hot Line Report <input checked="" type="checkbox"/> Journal Articles/Conference Papers and Proceedings <input type="checkbox"/> Software <input type="checkbox"/> Other _____	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Form No.</th> <th style="text-align: center;">Freq.</th> <th style="text-align: center;">Number of Copies</th> </tr> </thead> <tbody> <tr> <td>DOE F 4600.3</td> <td>O,C</td> <td>3</td> </tr> <tr> <td>DOE F 4600.3A</td> <td>Q</td> <td>3</td> </tr> <tr> <td>DOE F 4600.5</td> <td>Q</td> <td>3</td> </tr> <tr> <td>DOE F 4600.6</td> <td>Q</td> <td>3</td> </tr> <tr> <td>SF-269 or SF-269A</td> <td>Q</td> <td>4</td> </tr> <tr> <td>None</td> <td>YF</td> <td>2</td> </tr> <tr> <td>None</td> <td>A</td> <td>2</td> </tr> <tr> <td>None</td> <td>FG</td> <td>2</td> </tr> <tr> <td>None</td> <td>O</td> <td>3</td> </tr> <tr> <td>None</td> <td>FC</td> <td>3</td> </tr> <tr> <td>F 580.1-8</td> <td>A</td> <td>1</td> </tr> <tr> <td>F 4440.5</td> <td>FC</td> <td>1</td> </tr> <tr> <td>SF-1428 or SF-120</td> <td></td> <td></td> </tr> <tr> <td>None</td> <td>A</td> <td>2</td> </tr> <tr> <td>None</td> <td>A</td> <td>2</td> </tr> </tbody> </table>	Form No.	Freq.	Number of Copies	DOE F 4600.3	O,C	3	DOE F 4600.3A	Q	3	DOE F 4600.5	Q	3	DOE F 4600.6	Q	3	SF-269 or SF-269A	Q	4	None	YF	2	None	A	2	None	FG	2	None	O	3	None	FC	3	F 580.1-8	A	1	F 4440.5	FC	1	SF-1428 or SF-120			None	A	2	None	A	2
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5. Frequency Codes and Due Dates: A - As required; see attached text for applicability. C - Change/revision, within 15 calendar days after event. FG - Final; within ninety (90) calendar days after the project period ends. FC - Final - End of Effort. M - Monthly; within twenty-five (25) calendar days after end of the report period. O - Once after award; within thirty (30) calendar days after award. Q - Quarterly; within thirty (30) calendar days after end of the calendar quarter or portion thereof. S - Semiannually; within thirty (30) calendar days after end of project year and project half-year. YF - Yearly; 90 calendar days after the end of project year. YP - Yearly Property -due 15 days after period ending 9/30.																																																	
6. Special Instructions: The forms identified in the checklist are available at http://www.netl.doe.gov/business/forms/forms.html . Alternate formats are acceptable provided the contents remain consistent with the form. All technical reports submitted to the DOE must be accompanied by a completed and signed <u>NETL F 510.1-5</u> addressing patent information.																																																	

4.4 GENERAL INSTRUCTIONS FOR THE PREPARATION AND SUBMISSION OF REPORTS (MAY 1999)

The Recipient shall prepare and submit (postage prepaid) the plans and reports indicated on the "Federal Assistance Reporting Checklist" to the addressee identified on the checklist. The level of detail the Recipient provides in the plans and reports shall be commensurate with the scope and complexity of the effort and shall be as delineated in the guidelines and instructions contained herein. The prime Recipient shall be responsible for acquiring data from any contractors or subrecipients to ensure that data submitted are compatible with the data elements which prime Recipients are required to submit to DOE.

4.5 FEDERAL ASSISTANCE MILESTONE PLAN (DOE F 4600.3) AND MILESTONE LOG (DOE F 4600.3A) (MAY 1999)

The milestone plan is used as a planning tool, establishing the time schedule for accomplishing the planned work. Usually, it is accompanied by the DOE F 4600.3A, "Milestone Log." The Milestone Plan portrays the major milestones of the project in bar chart format. The purpose of the plan is to establish the Recipient's time schedule for accomplishing planned events and milestones. It covers the life of the project and is to be organized by major project activities, such as those performed at work breakdown structure Level 2. Intermediate events and critical milestones are further identified in an attached "milestone log" and include the identification number, descriptive name of the event or milestone, and the scheduled date of completion.

4.6 FEDERAL ASSISTANCE MANAGEMENT SUMMARY REPORT (DOE F 4600.5) (MAY 1999)

This report is a graphic presentation of costs and milestone status that provides rapid visual analysis and trend forecasting. The funding levels should represent all available resources. The Recipient provides summary cumulative cost and activity data for each reporting period. (Refer to the back of the form for more detailed instructions.)

4.7 FEDERAL ASSISTANCE PROGRAM/PROJECT STATUS REPORT (DOE F 4600.6) (MAY 1999)

This report is a concise narrative describing the current status of the effort. The report allows Recipients to communicate developments, achievements, changes and problems. The award Recipient enters a brief narrative discussion of the following topics: approach changes; performance variances, accomplishments, or problems; open times; and status assessment and forecast. Each of these topics is addressed, as appropriate, for a given reporting period and the report is submitted periodically, as required, during the life of the project.

4.8 FINANCIAL STATUS REPORT (STANDARD FORM 269 OR 269A) (MAY 1999)

This report is used for the Recipient to provide regular periodic accounting of project funds expended. The accounting may be on either a cash or accrual basis. Actual total expenditures and obligations incurred, but not paid, are reported for each reporting period for each major activity. They should correlate with those identified on the "Federal Assistance Milestone Plan" when the "Federal Assistance Milestone Plan" is required. Provision is made to identify the Federal and non-Federal share of project outlays for each identified activity.

4.9 TECHNICAL REPORTS (SEP 2000)

CAUTION: Technical reports SHALL NOT include Limited Rights Data (such as restricted, proprietary or business sensitive information). Limited Rights Data shall be submitted in a separate appendix to the technical report. This appendix SHALL NOT be submitted in an electronic format but rather submitted in ONE ORIGINAL AND THREE (3) PAPER COPIES

along with the paper version of the sanitized technical report deliverable. The appendix shall be referenced in, but not incorporated into, the sanitized technical report deliverable under the contract. In accordance with FAR 52.227-14, Rights in Data-General, the appendix must be appropriately marked and identified.

Further, if this award authorizes the awardee under the provisions of The Energy Policy Act of 1992 to request protection from public disclosure for a limited period of time of certain information developed under this award, technical reports SHALL NOT contain such Protected EAct Information. Such information shall be submitted in a separate appendix to the technical report that is suitable for release after the agreed upon period of protection from public disclosure has expired. The appendix shall be referenced in, but not incorporated into, the sanitized technical report deliverable under the contract. In accordance with the clause titled "Obligations as to Protected Energy Policy Act (EAct) Information," the appendix must be appropriately marked and identified.

All TECHNICAL REPORTS submitted to the DOE MUST be accompanied by a completed and signed NETL F 510.1-5, addressing potentially patentable information.

4.10 TECHNICAL PROGRESS REPORT (ANNUAL, QUARTERLY, AND SEMI-ANNUAL (MAY 1999))

The body of the report should contain a full account of progress, problems encountered, plans for the next reporting period, and an assessment of the prospects for future progress.

The Technical Progress Report should include sufficient detail to allow the work to be reproduced by others. Results and reduced data shall be presented together with a discussion of the relevance of the findings. When experimental systems and/or procedures are being utilized for the first time, they shall be described in detail. This description shall contain detailed information on equipment and procedures utilized, as well as providing a rationale for their use. All data reduction and transformation methods shall be fully documented. For every fourth calendar quarter for quarterly reports or every second half year for semi-annual reports, the report should be expanded to provide for detailed information on the results of the past year, problems encountered, significant accomplishments, listing of publications, presentations, and approaches to be taken the following year.

Informational items in technical progress reports shall include:

Experimental Apparatus -- A comprehensive description, including dimensioned drawings or sketches, of the apparatus and associated diagnostic measurement equipment employed to perform the experimental research.

Experimental and Operating Data -- All experimental data acquired during the course of research including detailed characterization of the sample materials subjected to experimentation.

Data Reduction -- A complete description of the methods employed to transform raw measured data into a form usable for interpretation along with any assumptions or restrictions inherent in the method and the resultant reduced data.

Hypothesis and Conclusions -- Logic for drawing conclusions or developing hypotheses shall be clearly stated along with applicable assumptions or restrictions.

4.11 TOPICAL REPORT (MAY 1999)

These reports usually provide a comprehensive statement of the technical results of the work performed for a specific task or subtask of the Statement of Project Objectives, or detail

significant new scientific or technical advances. If required, DOE shall review and approve the report outline prior to submission of the report.

4.12 FINAL TECHNICAL REPORT (AUG 2000)

The Final Report shall document and summarize all work performed during the award period in a comprehensive manner. It shall also present findings and/or conclusions produced as a consequence of this work. This report shall not merely be a compilation of information contained in subsequent quarterly, or other technical reports, but shall present that information in an integrated fashion, and shall be augmented with findings and conclusions drawn from the research as a whole.

4.13 GUIDELINES FOR ORGANIZATION OF TECHNICAL REPORTS (DEC 1999)

The following sections should be included (as appropriate) in technical reports in the sequence shown. Any section denoted by an asterisk is required in all technical reports.

TITLE PAGE* - The Title Page of the report itself must contain the following information in the following sequence:

Report Title
Type of Report (Quarterly, Semi-Annual, Annual, Topical, Final)
Reporting Period Start Date
Reporting Period End Date
Principal Author(s)
Date Report was Issued (Month [spelled out] and Year [4 digits])
DOE Award Number (e.g., DE-FG26-99NT12345) and if appropriate, task number
Name and Address of Submitting Organization (This section should also contain the name and address of significant subcontractors or subrecipients who participated in the production of the report.)

DISCLAIMER* -- The Disclaimer must follow the title page, and must contain the following paragraph:

"This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof."

ABSTRACT* - should be a brief, concise summary of the report.

TABLE OF CONTENTS*

LIST(S) OF GRAPHICAL MATERIALS

INTRODUCTION

EXECUTIVE SUMMARY - this should be a well organized summary that highlights the important accomplishments of the research during the reporting period. It should be no less than one page and no more than two pages in length, and should be single spaced. This summary must be more comprehensive than the traditional "abstract."

EXPERIMENTAL* - this should describe, or reference all experimental methods being used for the research. It should also provide detail about materials and equipment being used. Standard methods can be referenced to the appropriate literature, where details can be obtained. Equipment should be described only if it is not standard, or if information is not available thru the literature or other reference publications.

RESULTS AND DISCUSSION* - It is extremely important that this section includes enough relevant data, especially statistical data, to allow the project manager to justify the conclusions. With the relevant data, explain how the data was interpreted and how it relates to the original purpose of the research. Be concise in the discussion on how this research effort solved or contributed to solving the original problem.

CONCLUSION* - The conclusion should not simply reiterate what was already included in the "Results and Discussion" section. It should, however, summarize what has already been presented, and include any logical implications of how the successes are relevant to technology development in the future. This is extremely important, since "relevancy" continues to be a criteria of the program.

REFERENCES*

BIBLIOGRAPHY

LIST OF ACRONYMS AND ABBREVIATIONS

APPENDICES (IF NECESSARY)

Company Names and Logos -- Except as indicated above, company names, logos, or similar material should not be incorporated into reports.

Copyrighted Material -- Copyrighted material should not be submitted as part of a report unless written authorization to use such material is received from the copyright owner and is submitted to DOE with the report.

Measurement Units -- All reports to be delivered under this instrument shall use the SI Metric System of Units as the primary units of measure. When reporting units in all reports, primary SI units shall be followed by their U.S. Customary Equivalents in parentheses ().

The Recipient shall insert the text of this clause, including this paragraph, in all subcontracts under this award.

Note: SI is an abbreviation for "Le Systeme International d'Unites."

4.14 ELECTRONIC MEDIA STANDARD FOR PREPARATION OF TECHNICAL REPORTS (DEC 1999)

FILE FORMAT

Production of high-quality, electronic documents is dependent on the quality of the input that is provided. Thus, the Recipient shall submit one good quality paper copy using either permanent or alkaline paper plus an electronic version of each technical report.

ELECTRONIC REPORTS SHALL BE SUBMITTED IN THE ADOBE ACROBAT PORTABLE DOCUMENT FORMAT (PDF). ELECTRONIC REPORTS SUBMITTED IN A FORMAT OTHER THAN ADOBE WILL BE RETURNED AND THE REPORT CONSIDERED DELINQUENT.

Each report shall be an integrated file that contains all text, tables, diagrams, photographs, schematics, graphs, and charts.

SUBMISSION FORMAT

The electronic file(s) shall be submitted via diskette or CD-ROM. Diskettes or CD-ROMs must be labeled as follows:

DOE Award Number
Type/Frequency of Report(s)
Reporting Period (if applicable)
Name of submitting organization
Name, phone number and fax number of preparer

Diskettes -- Diskettes must be 3.5" double-sided, high-density (1.4 M Byte capacity). If file compression software is used to transmit a PDF file spanning more than one diskette, PKZIP from PKWare, Inc., is the required compression software. State the number of diskettes in the set (e.g., 1/3)

CD-ROM -- The electronic file(s) may be submitted on an ISO9660-format CD-ROM.

FILE NAMING

In naming the electronic file, the Recipient shall use the standard eight-character naming convention for the main file name, and the three character extension applicable to the software use, e.g., .pdf for Adobe.

For the main file name, the first five characters are the last five digits from the award number; e.g., for Award Number DE-FG26-97NT12345, the first five characters are 12345.

The next character represents the technical report and will always be designated as "R".

The remaining two characters indicate the chronological number of the particular type of report; e.g., Quarterly Technical Progress Reports for a 5-year award are numbered R01 through R20. Thus, the main file name for the sixth Quarterly Technical Progress Report under Award No. DE-FG26-99NT12345 would be 12345R06.PDF. If monthly, quarterly, annual, and a final technical report are required, the numbers would run from R01 through R86 (60 monthly reports, 20 quarterly reports, 5 annual reports, and 1 final report).

4.15 ENVIRONMENTAL (OCT 2000)

In response, in part, to the requirements of the National Environmental Policy Act of 1969 (NEPA) and other related environmental statutes, the National Energy Technology Laboratory (NETL) requires the submission of various documents that assess the environmental aspects and projected impacts of all of its proposed actions. These documents may include the following:

(1) Hazardous Substance Plan, (2) Hazardous Waste Report, (3) Environmental Compliance Plan, (4) Environmental Monitoring Plan, and (5) Environmental Status Reports.

The environmental information provided in these documents will enable NETL to fulfill its responsibilities under NEPA (additional information about the requirements of the National Environmental Policy Act can be found in the DOE NEPA Compliance Guide and 10 CFR 1021) and to monitor the Recipient's compliance with other environmental regulations. The implementation of any task associated with a proposed action will be dependent upon DOE completing necessary NEPA documentation. Therefore, to minimize the risk of project delays, it is imperative that these reports be submitted in a timely manner.

The information contained herein specifies the basic environmental requirements for this award, but it is not to be interpreted as containing all necessary information for any given project. Likewise, certain aspects of the requirements may not be applicable. Accordingly, the level of information provided should be sufficient for DOE to assess the environmental implications of the proposed action.

4.16 HAZARDOUS SUBSTANCE PLAN (MAY 1999)

The Recipient shall submit a Hazardous Substance Plan not later than thirty (30) days after initial award. The Plan shall specifically identify each Hazardous Substance (as defined under 40 CFR 261, Subpart D, entitled Lists of Hazardous Wastes) anticipated to be purchased, utilized or generated in the performance of this award. For each such Hazardous Substance identified, the Plan shall specifically provide the following information:

- Description of Substance/Chemical
- EPA Hazardous Waste Number
- EPA Hazard Code
- Anticipated Quantity to be purchased, utilized or generated
- Anticipated Hazardous Waste Transporter
- Anticipated Hazardous Waste Disposal Facility Contractor and Location (City/Municipality, State)
- Anticipated Treatment Method

4.17 HAZARDOUS WASTE REPORT (MAY 1999)

The Recipient shall submit a Hazardous Waste Report at the completion of award performance. The Report shall specifically identify each Hazardous Waste (as defined under 40 CFR 261, Subpart D, entitled Lists of Hazardous Wastes) actually utilized, or generated in the performance of this award. For each such Hazardous Waste identified, the Report shall specifically provide the following information:

- Description of Substance/Chemical
- EPA Hazardous Waste Number
- EPA Hazard Code
- Actual Quantity Disposed
- Actual Hazardous Waste Transporter
- Actual Hazardous Waste Disposal Facility Contractor and Location (City/Municipality, State)
- Actual Disposal Date
- Actual Treatment Method

The Hazardous Waste Report is intended as a final reconciliation of anticipated versus actual Hazardous Substances purchased, utilized, or generated in the performance of this award.

4.18 PROPERTY REPORTS (DEC 1999)

The NETL Property Handbook entitled "Management of Government Property in the Possession of Contractors," contains forms, instructions, and suggested formats for submission of property reports. This handbook can be found at <http://www.netl.doe.gov/business/index.html>.

4.19 REPORT OF TERMINATION OR COMPLETION INVENTORY (SF-1428 AND SF-120) (SEP 2000)

This report submitted on the NETL F 580.1-9 is due immediately upon completion or termination of the award. The SF-120 is also required if there is Government-furnished property involved. The Recipient is required to perform and cause each subcontractor to perform a physical inventory, adequate for disposal purposes, of all Government property applicable to the award.

4.20 HOT LINE REPORT (NOV 2000)

The "Hot Line Report" may be used to report a major breakthrough in research, development, or design; an event causing a significant schedule slippage or cost growth; an environmental, safety and health violation; achievement of or failure to achieve an important technical objective; or any requirement for quickly documented direction or redirection. The report shall be submitted by the most rapid means available, usually electronic, and should confirm telephone conversations with DOE representatives. Identification as a "Hot Line Report" serves notice at each link in the delivery chain that expedition in handling is required. Unless otherwise agreed by the parties involved, DOE is expected to take action and respond in a similarly timely manner. The report should include:

1. Recipient's name and address;
2. Award title and number;
3. Date;
4. Brief statement of problem or event;
5. Anticipated impacts; and
6. Corrective action taken or recommended.

Hot line reports shall document the incidents listed below:

1. Any single fatality or injuries requiring hospitalization of five or more individuals is to be immediately reported.
2. Any significant environmental permit violation is to be reported as soon as possible, but within 24 hours of the discovery of the incident.
3. Other incidents that have the potential for high visibility in the media are to be reported as quickly as possible, but within 24 hours following discovery.
4. Any failure resulting in damage to Government-owned equipment in excess of \$50,000 is to be reported as quickly as possible, but within 24 hours of the discovery of the failure.
5. Any unplanned event which is anticipated to cause a schedule slippage or cost increase significant to the project is to be reported within 24 hours.

6. Any verbal or written Notice of Violation of any Environmental, Safety, and Health statutes arising from the performance of this award is to be immediately reported.
7. Any accidental spill or release which is in violation of any Environmental, Safety, and Health statutes arising from the performance of this award is to be immediately reported, but within 24 hours of the discovery of the accident.
8. Any incident which causes a significant process or hazard control system failure, or is indicative of one which may lead to any of the above defined incidents, is to be reported as soon as possible, but within 5 days of discovery.

The requirement to submit Hot Line Reports for the incidents identified in 1, 2, 3, 6, or 7 is for the sole purpose of enabling DOE officials to respond to questions relating to such events from the media and other public.

When an incident is reported in accordance with 4, 5, 6, 7, or 8, the Recipient shall conduct an investigation of its cause and make an assessment of the adequacy of resultant action. A written report is required no later than ten (10) calendar days following the incident and shall include an analysis of the pertinent facts regarding the cause, and a schedule of the remedial events and time periods necessary to correct the action.

When an event results in the need to issue a written or verbal statement to the local media, the statement is to be cleared first; if possible, and coordinated with NETL Communications and Public Affairs Division, the Contracting Officer Representative (COR) and the Contracting Officer.

4.21 JOURNAL ARTICLES, CONFERENCE PAPERS AND PROCEEDINGS GENERATED BY LARGE BUSINESSES FOR DOE REVIEW (SEP 2000)

The Recipient shall submit to DOE for review and approval all documents generated by the Recipient, or any subcontractor, which communicate the results of scientific or technical work supported by DOE under this award, whether or not specifically identified in the award, prior to submission for publication, announcement, or presentation. Such documents include journal articles, conference papers and proceedings, etc. Each such document shall be accompanied by a properly completed NETL Form 510.1-5, "Request for Patent Clearance for Release of Contracted Research Documents."

The Recipient shall simultaneously submit a draft version of the document to the DOE COR and the DOE Patent Counsel Office prior to the publication, presentation, or announcement. The document submitted to the DOE Patent Counsel shall be accompanied by a completed NETL Form 510.1-5. The DOE COR and DOE Patent Counsel shall review the draft version of the document and notify the Recipient of approval or recommended changes. The approved final version shall be submitted to the NETL AAD Document Control Coordinator.

The following information shall be provided for conference papers and proceedings, etc.

- Name of conference
- Location of conference (city, state, and country)
- Date of conference (month/day/year)
- Conference sponsor

4.22 JOURNAL ARTICLES, CONFERENCE PAPERS AND PROCEEDINGS GENERATED BY A SMALL BUSINESS OR NONPROFIT ORGANIZATION FOR DOE REVIEW (SEPT 2000)

The Recipient shall submit to DOE for review and approval all documents generated by the Recipient, or any subcontractor, which communicate the results of scientific or technical work supported by DOE under this award, whether or not specifically identified in the award, prior to submission for publication, announcement, or presentation. Such documents include journal articles, conference papers and proceedings, etc. Each such document shall be accompanied by a properly completed NETL Form 510.1-5, "Request for Patent Clearance for Release of Contracted Research Documents."

The Recipient shall submit a draft version of the document to the COR prior to the publication, presentation, or announcement. The COR shall review the draft version of the document and notify the Recipient of approval or recommended changes. The final version, along with a completed NETL Form 510.1-5, shall be submitted to the NETL AAD Document Control Coordinator.

The following information shall be provided for conference papers and proceedings, etc.

- Name of conference
- Location of conference (city, state, and country)
- Date of conference (month/day/year)
- Conference sponsor

4.23 JOURNAL ARTICLES, CONFERENCE PAPERS AND PROCEEDINGS GENERATED BY A UNIVERSITY FOR DOE REVIEW (SEPT 2000)

The Recipient shall submit to DOE for review and comment all documents generated by the Recipient, or any subcontractor, which communicate the results of scientific or technical work supported by DOE under this award, whether or not specifically identified in the award, prior to submission for publication, announcement, or presentation. Such documents include journal articles, conference papers and proceedings, etc. Each such document shall be accompanied by a properly completed NETL Form 510.1-5, "Request for Patent Clearance for Release of Contracted Research Documents."

The Recipient shall submit a draft version of the document to the COR prior to the publication, presentation, or announcement. The COR shall review the draft version of the document and notify the Recipient of recommended changes. The final version, along with a completed NETL Form 510.1-5, shall be submitted to the NETL AAD Document Control Coordinator.

The following information shall be provided for conference papers and proceedings, etc.

- Name of conference
- Location of conference (city, state, and country)
- Date of conference (month/day/year)
- Conference sponsor

4.24 ATTACHMENT C -- BUDGET PAGES (DEC 1999)

The budget documents (DOE Form 4620.1, ER F4620.1A, SF424 or the DOE 4600.4) will be inserted on this page upon award.

The Applicant must prepare the budget documents and include them in Volume I - Business and Financial Application. These documents and instructions for completion of the documents can be found on the NETL Homepage at: <http://www.netl.doe.gov/business/forms/forms.html>.

4.25 ATTACHMENT D -- RECIPIENT ACQUIRED PROPERTY (AUG 1999)

Recipient acquired property will be listed on this page upon award.

SECTION V -- CONDITIONS AND NOTICES

5.1 NUMBER AND TYPE OF AWARDS (JAN 2000)

It is anticipated that there will be multiple awards resulting from this solicitation. However, the Government reserves the right to fund, in whole or in part, any, all, or none of the applications submitted in response to this solicitation and will award that number of financial assistance instruments which serves the public purpose and is in the best interest of the Government. The Government intends to use cooperative agreements as the type of award instrument(s).

5.2 COST SHARING REQUIREMENTS (DEC 1999)

In accordance with 10 CFR 600.30, the DOE has determined that a minimum cost share for this project is 20%. Cost sharing must meet the requirements of 10 CFR 600.123 and 10 CFR 600.224. Allowable costs for cost sharing shall be in accordance with 10 CFR 600.127 and 10 CFR 600.222.

5.3 CONTENT OF RESULTING AWARD (NOV 2000)

Any agreement awarded as a result of this solicitation will contain the applicable terms and conditions found in the Model Financial Assistance Agreement.

Blank areas appearing in the model agreement indicated by "[]" will be completed after negotiations.

5.4 APPLICATION PREPARATION COSTS (DEC 1999)

This solicitation does not obligate the Government to pay any costs incurred in the preparation and submission of applications, or in making necessary studies or designs for the preparation thereof or to acquire, or contract for any services.

5.5 COMMITMENT OF PUBLIC FUNDS (AUG 1999)

The Contracting Officer is the only individual who can legally commit the Government to the expenditure of public funds in connection with the proposed award. Any other commitment, either explicit or implied, is invalid.

5.6 AVAILABILITY OF FUNDS (AUG 1999)

It is estimated that \$16,000,000 will be available for award under this solicitation, subject to the availability of funds.

5.7 PRE-APPLICATION CONFERENCE IS NOT PLANNED (JULY 1999)

A pre-application conference is not contemplated.

5.8 FALSE STATEMENTS (AUG 1999)

Applications must set forth full, accurate, and complete information as required by this solicitation. The penalty for making false statements in applications is prescribed in 18 U.S.C. 1001.

5.9 QUESTIONS/AMENDMENTS TO SOLICITATION (AUG 2000)

All requests for explanation or interpretation of any part of the solicitation shall be submitted in writing and must be received by the Contract Specialist via E-mail or in writing not later than January 26, 2001. The Government reserves the right not to respond to questions submitted after this date, nor to respond to questions submitted by telephone or in person at any time.

If the Government elects to answer the questions, without reference to the originating source, the questions will be answered via an associated file to the solicitation entitled, "Questions and Answers" posted along with the solicitation and any applicable amendments on the NETL's Internet URL at {<http://www.netl.doe.gov/business/solicit>}.

The only method by which any term of this solicitation may be amended is by an express, formal amendment generated by the issuing office. No other communication, whether written or oral will amend or supersede the terms of this solicitation.

Amendments to the solicitation will be posted on NETL's website @ <http://www.netl.doe.gov/business/solicit/>. Applicants are encouraged to periodically check the NETL Homepage to ascertain the status of any amendments as hard copies will not be distributed.

5.10 CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER (CFDA) (AUG 1999)

81.036 Energy-Related Inventions

5.11 APPLICANT ELIGIBILITY (MAY 2000)

Any non-profit or for-profit organization, university or other institution of higher education, or non-federal agency or entity is eligible to apply, unless otherwise restricted by the Simpson-Craig Amendment.

Applicants that are seeking financial assistance under this solicitation, are subject to the eligibility requirements of Section 2306 of the Energy Policy Act of 1992 (EPAct).

5.12 PARTICIPATION BY FEDERALLY FUNDED RESEARCH AND DEVELOPMENT CENTERS (FFRDC) AND DEPARTMENT OF ENERGY (DOE) MANAGEMENT AND OPERATIONS (M&O) CONTRACTORS (JAN 2000)

Applications submitted by, or on behalf of: (1) another Federal agency; (2) a Federally Funded Research and Development Center sponsored by another Federal agency; or (3) a Department of Energy (DOE) Management and Operating (M&O) contractor will not be eligible for an award under this solicitation. However, an application that includes performance of a portion of the work by a DOE M&O contractor will be evaluated and may be considered for award, provided the proposed use of any such entity is specifically authorized in writing by the responsible DOE Contracting Officer or authorized designee and the applicant provides the additional information identified in Section VII - BUSINESS AND FINANCIAL PREPARATION INSTRUCTIONS. The responsible DOE Contracting Officer must determine that performance by the M&O contractor: 1) is consistent with or complementary to DOE missions and the missions of the facility to which the work is to be assigned; 2) will not adversely impact execution of assigned programs of the facility; 3) will not place the facility in direct competition with the domestic private sector; and 4) will not create a detrimental future burden on DOE resources.

If a project which includes M&O participation is approved for funding, DOE intends to make an award to the applicant for its portion of the effort and to provide direct funding for the M&O's portion of the effort under the existing DOE M&O contract. The M&O contractor's work scope therefore will not be accomplished through a contract with a recipient as defined in 10 CFR Part 600.3. However, the recipient will be the responsible authority, without recourse to DOE, regarding the settlement and satisfaction of all contractual and administrative issues, including but not limited to disputes and claims, arising out of any agreement between the applicant and the M&O contractor.

If a recipient uses an M&O contractor to perform a portion of the work, the recipient's cost sharing requirement would be based on the total cost of the project, including both the recipient's and the M&O's portions of the effort.

5.13 TIME, DATE AND PLACE APPLICATIONS ARE DUE (NOV 2000)

Applications shall be submitted in paper media in sealed envelopes or packages addressed to the office and point of contact specified below:

APPLICATIONS MUST BE RECEIVED AT THE FOLLOWING MAILING ADDRESS NO LATER THAN 4:00 P.M. LOCAL PREVAILING TIME ON FEBRUARY 9, 2001.

U. S. Department of Energy
National Energy Technology Laboratory
626 Cochrans Mill Road, MS 921-107
Pittsburgh, PA 15236-0940

Point of Contact : John R. Columbia
Telephone Number: 412-386-6144
Fax Number 412-386-6137
E-MAIL Address: Columbia@netl.doe.gov

External Marking of Applications

Applications shall be marked with the following information:

- (1) Address of Proposer
- (2) Solicitation Number
- (3) Due Time and Date of Applications
- (4) Point of Contact at Issuing Office

5.14 FEE AND PROFIT (JULY 1999)

Fee or profit will not be paid to the recipients of financial assistance awards resulting from this solicitation.

5.15 DETERMINATION OF RESPONSIBILITY (AUG 1999)

DOE will evaluate the potential Recipient's responsibility before award. Responsibility determinations are focused on the Recipient's capability to manage and account for the funds, property and other assets provided to perform satisfactorily under the terms of the award. If a potential Recipient is determined to not be in compliance or cannot or will not comply with generally applicable requirements (see 10 CFR Part 600, Appendix A), the contracting officer will find the Recipient not responsible and may either disapprove the application or use special restrictive conditions as a term of award.

5.16 TREATMENT OF PROPRIETARY INFORMATION (AUG 1999)

An application may include technical data and other data, including trade secrets and/or privileged or confidential commercial or financial information, which the applicant does not want disclosed to the public or used by the Government for any purpose other than application evaluation. To protect such data, the applicant should specifically identify each page including each line or paragraph thereof containing the data to be protected and mark the cover sheet of the application with the following Notice as well as referring to the Notice on each page to which the Notice applies:

NOTICE OF RESTRICTION ON DISCLOSURE AND USE OF DATA

The data contained in pages [] of this application have been submitted in confidence and contain trade secrets or proprietary information, and such data shall be used or disclosed only for evaluation purposes, provided that if this applicant receives an award as a result of or in connection with the submission of this application, DOE shall have the right to use or disclose the data therein to the extent provided in the award. This restriction does not limit the Government's right to use or disclose data obtained without restriction from any source, including the applicant.

DOE shall not refuse to consider an application solely on the basis that the application is restrictively marked.

5.17 TELEGRAPHIC AND E-MAIL APPLICATIONS (SEP 2000)

Telegraphic and e-mail applications will **NOT** be considered. The term "Telegraphic" includes both mailgrams and facsimile submissions.

5.18 LATE APPLICATIONS, AMENDMENTS AND WITHDRAWALS OF APPLICATIONS (AUG 2000)

An application or amendment of an application shall be timely if it is received at the location on or before the deadline date and time specified in this section.

Applications or amendments of applications may be withdrawn by written notice at any time before award. Written notice includes E-mails and facsimiles. An authorized representative may withdraw applications in person, if the representative's identity is made known and the representative signs a receipt for the application before award. Applications will not be returned unless they are timely withdrawn.

5.19 EVALUATION PERSONNEL (AUG 2000)

Applications will be evaluated in accordance with the criteria set forth in Section VI of the solicitation. In conducting this evaluation, the Government may utilize assistance and advice from qualified personnel from other Federal Agencies, DOE Contractors, universities and industry. Applicants not wishing to have their application evaluated by nonfederal personnel shall indicate their "non-consent" in Volume I. Applicants are further advised that DOE may be unable to consider an application withholding such consent.

When using personnel from other Federal agencies, DOE contractors, or other consultants to DOE in the evaluation of applications, DOE will obtain assurances from all evaluators that DOE's commitments are met relating to the proprietary nature of any application information.

5.20 APPLICATION CLARIFICATION (JULY 1999)

DOE reserves the right to require applications to be clarified or supplemented to the extent considered necessary either through additional written submissions or oral presentations.

5.21 AWARD WITHOUT DISCUSSIONS (AUG 2000)

Notice is given that award may be made after few or no exchanges, discussions or negotiations. Therefore, all applicants are advised to submit their most favorable application to the Government. The Government reserves the right, without qualification, to reject any or all applications received in response to this solicitation and to select any application, in whole or in part, as a basis for negotiation and or award.

5.22 ANTICIPATED SELECTION AND AWARD DATES (AUG 1999)

It is anticipated that selections for award will be made by June 1, 2001. Awards are expected to be made within 60 calendar days following the selection.

5.23 APPLICATION ACCEPTANCE PERIOD (AUG 1999)

The minimum application acceptance period shall be 180 calendar days after the deadline(s) for receipt of applications.

5.24 PRESUBMISSION REVIEW AND CLEARANCES (AUG 1999)

Presubmission review under Executive Order 12372, "Intergovernmental Review of Federal Programs" is not required.

5.25 PROJECT PERIOD (AUG 2000)

The Government anticipates the project period for the subject awards to be between ten months and three years. Awards will have project and budget periods that are specific to the project and funding.

5.26 SIMPSON-CRAIG AMENDMENT (AUG 1999)

Organizations which are described in section 501(c)(4) of the Internal Revenue Code of 1986 and engage in lobbying activities after December 31, 1995, shall not be eligible for the receipt of Federal funds constituting an award, grant, or loan. Section 501(c)(4) of the Internal Revenue Code of 1986 covers:

"Civic leagues or organizations not organized for profit but operated exclusively for the promotion of social welfare, or local associations of employees, the membership of which is limited to the employees of a designated person or persons in a particular municipality, and the net earnings of which are devoted exclusively to charitable, educational or recreational purposes."

Lobbying activities are defined broadly to include, among other things, contacts on behalf of an organization with specified employees of the Executive Branch and Congress with regard to Federal legislative, regulatory and program administrative matters.

5.27 LOANS NOT AVAILABLE (JULY 1999)

Loans are not available under the DOE Minority Economic Impact (MEI) loan program, 10 CFR Part 800, to finance the cost of preparing a financial assistance application.

5.28 DEBRIEFINGS (AUG 2000)

Each unsuccessful applicant will be offered the opportunity for an explanation or debriefing as to why the application was not selected. Debriefings will be conducted at the earliest feasible time. Written notice will be provided to unsuccessful applicants after selection in accordance with 10 CFR 600.19. Information about selected projects will be made publicly available.

5.29 ADDITIONAL ELIGIBILITY REQUIREMENTS OF THE ENERGY POLICY ACT OF 1992 (JULY 1999)

Awards under this solicitation also are subject to the eligibility requirements stated in Section 2306 of the Energy Policy Act of 1992 (EPAcT). An applicant private sector firm shall be eligible to receive financial assistance under this section only if it is a United States-owned company, or the firm is incorporated in the United States and has a parent company which is incorporated in a country which affords to United States-owned companies: (1) opportunities comparable to those afforded to any other company to participate in any joint venture similar to the one described in this solicitation; and (2) adequate and effective protection for United States companies' intellectual property rights.

In addition, the applicant must show that the project, as a whole, is in the economic interest of the United States. To fulfill this requirement, the applicant must consider the contributions of all participants in the project, including any contractors or suppliers that the applicant has named and relied upon in its application. This can be evidenced by: (1) investment in the United States in research, development, and manufacturing, such as the manufacture of major components or subassemblies in the United States; (2) significant contributions to employment in the United States; (3) agreement with respect to any technology arising from assistance provided under this solicitation to promote the manufacture within the United States of products resulting from that technology, taking into account the goals of promoting the competitiveness of United States industry, and to procure parts and materials from competitive suppliers.

All applicants shall complete documentation providing a certification of eligibility under Section 2306 of the EPAcT. Based on the information received, a determination by DOE that the EPAcT eligibility requirements are met should be made prior to award of an agreement.

5.30 NATIONAL ENVIRONMENTAL POLICY ACT STRATEGY (NOV 2000)

The National Environmental Policy Act of 1969 (NEPA) establishes a national policy to ensure that consideration is given to environmental values and factors in Federal planning and decision making. The Department of Energy's policy is to comply fully with the letter and spirit of NEPA. To ensure that environmental factors are considered in the decision making process and to promote environmentally responsible decisions, DOE incorporates NEPA requirements early in the planning process for proposed actions. Consistent with Council on Environmental Quality (CEQ) NEPA regulations (40 CFR Parts 1500-1508) and DOE NEPA regulations (10 CFR Part 1021), an overall strategy for compliance with NEPA has been developed. This includes performing project-specific environmental reviews under 10 CFR 1021.216 of environmental issues pertinent to each proposed project before projects are

selected, followed by site-specific environmental reviews under NEPA of each project after DOE selection.

No action taken by DOE with regard to any application prior to the completion of the site-specific analysis, including project selection or award, shall be a final decision for purposes of compliance with NEPA.

5.31 PRE-SELECTION PROJECT-SPECIFIC ENVIRONMENTAL QUESTIONNAIRE (DEC 1999)

For Applications that undergo comprehensive evaluation, DOE will review under 10 CFR 1021.216, project-specific environmental information supplied by the applicant on the Environmental Questionnaire which is submitted as part of Volume I, Business and Financial application. The environmental information provided by the applicant is independently evaluated by DOE and documented in the form of an environmental critique, which may also include supplemental information developed by DOE. Subsequently, DOE prepares a publicly available environmental synopsis to document the consideration given to environmental factors and to record that the relevant environmental consequences of reasonable alternatives have been evaluated in the selection process.

5.32 POST-SELECTION ENVIRONMENTAL REVIEW (DEC 1999)

Soon after selection, which shall be contingent as specified in 10 CFR 1021.216(i), depending on the information necessary to satisfy NEPA, applicants may be requested to provide additional environmental information which is more detailed than that provided on the Environmental Questionnaire of this solicitation. This detailed site-and project-specific information may be used as the basis for site-specific NEPA documents prepared by DOE for each selected project. Such NEPA documents shall be prepared, considered, and published by DOE in full conformance with the requirements of the CEQ regulation and DOE NEPA regulations. DOE must complete its appropriate NEPA process before a go/no go decision and before a recipient may proceed with detailed design under the award.

5.33 POST-AWARD ENVIRONMENTAL MONITORING (DEC 1999)

Each resulting award will specify the monitoring and reporting requirements necessary to ensure compliance with applicable environmental regulations, and permits obtained from Federal, state and local government agencies and DOE NEPA regulations.

5.34 52.227-6 ROYALTY INFORMATION. (APR 1984)

(a) Cost or charges for royalties. When the response to this solicitation contains costs or charges for royalties totaling more than \$250, the following information shall be included in the response relating to each separate item of royalty or license fee:

- (1) Name and address of licensor.
- (2) Date of license agreement.
- (3) Patent numbers, patent application serial numbers, or other basis on which the royalty is payable.
- (4) Brief description, including any part or model numbers of each contract item or component on which the royalty is payable.

- (5) Percentage or dollar rate of royalty per unit.
- (6) Unit price of contract item.
- (7) Number of units.
- (8) Total dollar amount of royalties.

(b) Copies of current licenses. In addition, if specifically requested by the Contracting Officer before execution of the contract, the offeror shall furnish a copy of the current license agreement and an identification of applicable claims of specific patents.

5.35 952.227-84 NOTICE OF RIGHT TO REQUEST PATENT WAIVER. (FEB 1998)

Offerors have the right to request a waiver of all or any part of the rights of the United States in inventions conceived or first actually reduced to practice in performance of the contract that may be awarded as a result of this solicitation, in advance of or within 30 days after the effective date of contracting. Even where such advance waiver is not requested or the request is denied, the contractor will have a continuing right under the contract to request a waiver of the rights of the United States in identified inventions, i.e., individual inventions conceived or first actually reduced to practice in performance of the contract. Domestic small businesses and domestic nonprofit organizations normally will receive the patent rights clause at DEAR 952.227-11 which permits the contractor to retain title to such inventions, except under contracts for management or operation of a Government-owned research and development facility or under contracts involving exceptional circumstances or intelligence activities. Therefore, small businesses and nonprofit organizations normally need not request a waiver. See the patent rights clause in the draft contract in this solicitation. See DOE's patent waiver regulations at 10 CFR part 784.

5.36 NOTICE REGARDING ELIGIBLE/INELIGIBLE ACTIVITIES (AUG 1999)

Eligible activities under this program include those which describe and promote the understanding of scientific and technical aspects of specific energy technologies, but not those which encourage or support political activities such as the collection and dissemination of information related to potential, planned or pending legislation.

5.37 UNNECESSARILY ELABORATE APPLICATIONS (SEP 2000)

Unnecessarily elaborate applications beyond those sufficient to present a complete and effective response to this solicitation are not desired. Elaborate art work and expensive visual presentations are neither necessary nor wanted.

5.38 APPLICATION PREPARATION INSTRUCTIONS -- GENERAL

- (a) General. Application content, preparation, and delivery must conform to the solicitation instructions. To aid in evaluation, applications shall be clearly and concisely written as well as being neat, indexed (cross-indexed as appropriate) and logically assembled. All information prescribed by the solicitation package shall be included in the application package.

Each volume is a stand alone document, therefore, some information provided may need to be included in both volumes.

(b) Overall Arrangement of Application.

The overall application shall consist of two (2) physically separated volumes, individually entitled as stated below. Submit the required number of each application volume shown in the matrix below. Each volume shall employ the coversheets as described in the Appendices's instructions.

Volume	Original	Number of Copies	Electronic Version*
Volume I -- Business and Financial Application	1	3	--
Volume II -- Technical Application	1	6	1

* Electronic version of the technical application shall be submitted via diskette or CD-ROM in Adobe Acrobat Portable Document Format, WordPerfect, or Word. Applicants can choose to submit the entire Volume II electronically, or at a minimum, provide the Proposal Supplemental Form, Abstract, Workplan and Statement of Project Objectives electronically.

(c) Content of Applications.

1. Volume I -- Business and Financial Application preparation instructions are located in Section VII, Appendix A.
2. Volume II -- Technical Application preparation instructions are located in Section VIII, Appendix B.

SECTION VI -- EVALUATION CRITERIA AND PROGRAM POLICY FACTORS

6.1 INTRODUCTION (MAY 2000)

This section contains the evaluation approach as well as the individual criteria to be used in the evaluation of applications.

6.2 GENERAL (JULY 1999)

It is the policy of DOE that any financial assistance be awarded through a merit-based selection process which means a thorough, consistent and independent examination of applications based on pre-established criteria by persons knowledgeable in the field of the proposed project.

6.3 PRELIMINARY EVALUATION (SEP 2000)

Prior to a comprehensive evaluation, applications will undergo an initial review to determine whether the information required by the solicitation has been submitted and is properly completed. Applications will be reviewed for relevance to the "Energy Efficient Building Equipment and Envelope Technologies, Round III" program and for responsiveness to the requirements of the solicitation. Applications submitted in response to solicitations that require cost-sharing will be reviewed to insure that this requirement has been met. Volume I of the application will be reviewed to assess the Applicant's eligibility under the lobbying, EPA Act and Simpson-Craig Amendment requirements. Failure to successfully meet any one of these Preliminary Evaluation criteria may result in the elimination of the application and no further consideration in the Comprehensive Evaluation. In the event that an application is eliminated, a notice will be sent to the Applicant stating the reason(s) that the application will not be considered for financial assistance under this solicitation.

6.4 COMPREHENSIVE EVALUATION (AUG 1999)

Applications passing the preliminary evaluation shall be subject to a comprehensive evaluation in accordance with the technical evaluation criteria listed in this section.

The technical evaluation is conducted to determine the merits of the technical application with regard to the potential success of the project as well as future commercial applications. Comprehensive evaluation results in a numerical score for each application against each of the technical evaluation criteria.

The Environmental, Health, Safety, and Security (EHSS) Evaluation, which is not point scored, is conducted to determine the completeness of the Environmental Questionnaire, and to assess the applicant's awareness of EHSS requirements for mitigating project related EHSS risks and impacts.

The cost evaluation, which is not point scored, is conducted to determine the completeness of the cost estimate, appropriateness and reasonableness of the cost, and to assess the applicant's understanding of the Statement of Project Objectives.

6.5 TECHNICAL EVALUATION CRITERION (AUG 1999)

Technical applications submitted in response to this solicitation will be evaluated and scored in accordance with the criteria listed below. The evaluation criteria refer to the subject of the proposed project with the generic term "technology." In this case, "technology" means products, enabling technology, and basic information.

Criterion 1 Technical Merit

- Applications will be evaluated on the adequacy of the discussion of the need or problem the technology will address and the major issues and key risks in the development of the proposed technology. Applications will be evaluated on the evidence presented that the proposed technology is potentially technically superior to currently available technology.
- Applications will be evaluated on the appropriateness of the proposed approach to technology development given the current development status of the technology and the overall impact of successful project completion to future success in the marketplace. Applications will also be evaluated on the feasibility of the proposed technology, the scientific merit (based on sound scientific and engineering principles), and the degree to which the technology is innovative and unique.
- Applications will be evaluated on the clarity, completeness, and feasibility of the proposed work plan and schedule and on the appropriateness of milestones and performance metrics in the work plan for gauging technical progress.
- Applications will be evaluated on the reasonableness of proposed labor hours, labor categories, travel, consultants, and subcontractors as they apply to the performance of the proposed project.

Criterion 2 Energy, Environmental, and Economic Benefits

- Applications will be evaluated on the evidence presented for significant energy savings potential and technical performance expected from the proposed technology or product. Energy savings potential should be determined according to the guidelines contained in Section IX -- Appendix C.
- Applications will be evaluated on the evidence presented for significant environmental benefits from the proposed technology or product. Environmental benefits include, but are not limited to: reduced global warming potential, increased protection of the stratospheric ozone layer, lower direct releases of water, air and ground pollutants, improved indoor air quality, improved recyclability and beneficial human health impacts. Potential reductions in emissions of carbon dioxide from the proposed technology shall be determined according to the guidelines contained in Section IX -- Appendix C.
- Applications will be evaluated on the evidence presented for significant economic market potential for the proposed technology. The evaluation will focus on economic impacts beyond the monetary value of the estimated energy savings.

Criterion 3 Applicant and Participant Roles and Capabilities

- Applications will be evaluated on the demonstrated current corporate experience and success in similar projects resulting in successful technology development and commercialization or technology transfer.
- Applications will be evaluated on the experience and availability of key personnel to complete the proposed project. Relative to the nature and time

scale of the proposed project, team capabilities will be evaluated for both technical expertise and, if needed for the success of the project, product commercialization and/or technology transfer expertise.

- Applications will be evaluated on the adequacy (quality, availability, and appropriateness) of facilities and equipment to accommodate the proposed project.

Criterion 4 Industrial Involvement, Dissemination Plan and Commercialization Potential

- Applications will be evaluated on the completeness, practicality, and adequacy of the commercialization strategy for the results of the proposed project, including the adequacy of strategies to manage intellectual property rights, the adequacy of plans to disseminate results through appropriate gateways to the market and/or institutional alliances to execute the commercialization strategy. Results of projects can include hardware, data, software, system designs, etc., depending on the nature of the project.
- Applications will be evaluated on the viability and practicality of the proposed results to meet the needs of the target market in a cost effective manner without major market restructuring considering potential technical, regulatory, economic, environmental, production or other issues impacting market success.
- Applications will be evaluated on the demonstration of corporate commitment to the proposed project by exceeding the minimum required cost share and/or providing in-kind contributions to increase the probability of technical success and the potential for effective application of results in the marketplace.

6.6 COST EVALUATION CRITERIA (JULY 1999)

The costs proposed will be evaluated in response to this solicitation in order to:

- (a) determine the level of verifiable cost sharing,
- (b) ensure that all work elements included in the Statement of Project Objectives have associated costs, and that those costs appear appropriate and reasonable for the effort performed; and
- (c) assess the applicant's understanding of the Statement of Project Objectives.

6.7 RELATIVE ORDER OF IMPORTANCE OF EVALUATION CRITERIA (NOV 2000)

The evaluation of the technical application will be conducted using preestablished weights to determine the relative merits of the application in accordance with the technical evaluation criteria. The technical evaluation (Volume II - Technical Application) represents 100% of the total evaluation scoring. Although Volume I - Business and Financial Application will not be point scored, it will be considered in the selection decision and must be addressed.

The following weighting factors will be applied to each technical evaluation criteria to obtain a final evaluation rating for each application.

1.	Technical Merit	35%
2.	Energy, Environmental, and Economic Benefits	35%
3.	Applicant and Participant Roles and Capabilities	15%
4.	Industrial Involvement and Commercialization Potential	15%

6.8 APPLICATION OF PROGRAM POLICY FACTORS (NOV 2000)

These factors, while not indicators of the Applicant's merit, e.g., technical excellence, cost, proposer's ability, etc., may be essential to the process of selecting the application(s) that, individually or collectively, will best achieve the program objectives. Such factors are often beyond the control of the Applicant. Applicants should recognize that some very good applications may not receive an award because they do not fit within a mix of projects which maximizes the probability of achieving the DOE's overall research and development objectives. Therefore, the following Program Policy Factors may be used by the Source Selection Authority (SSA) to assist in determining which of the ranked application(s) shall receive DOE funding support:

Programmatic Balance: It may be desirable to select a project(s) for award that provides overall programmatic balance with respect to: technology category (equipment end uses, envelopes and whole buildings); building type (residential and/or commercial); time of commercialization (short-term or long-term), and project duration.

Diversity of Approach: It may be desirable to select a project(s) for award which provides diversity regarding technical approach and method.

Organizational Balance: It may be desirable to select a project(s) for award that provides a balanced programmatic effort with regard to technical perspective, as well as, different kinds and sizes of organizations.

Schedule: It may be desirable to select a project(s) for award that can make a more immediate contribution to the development of the technology and produce a market-ready product.

6.9 PROGRAMMATIC SOURCE OF FUNDS

DOE shall select a project(s) for award that best satisfy the budget authorities of available programmatic funding sources. [This solicitation is intended as a vehicle for supporting BTS R&D as a whole, as well as for supporting specific BTS programs. Note that certain potentially available programmatic funding sources have Congressional restrictions as to what programs and technical areas are applicable.]

6.10 BASIS FOR SELECTION AND AWARD (MAY 2000)

The Department of Energy anticipates the award of one or more financial assistance instruments to those applicants whose applications are determined to be in the best interest of the Department in achieving the program objectives set forth in this solicitation. Selection of an application by the Department will be achieved through a process of evaluating and comparing the relative merits of the applicant's complete application, in accordance with all of the evaluation factors set forth in this Section.

This process reflects the Department's desire to accept an application based on its potential in best achieving program objectives, rather than solely on evaluated technical merit or cost. Accordingly, the Department of Energy may select for award all, none, or any number or part, of an application, based on its decision as to which meritorious applications best achieve the program objectives set forth in this solicitation.

It is important for applicants to note that selection for negotiations will be made entirely on the basis of the applications submitted. Applications should, therefore, address specifically the factors mentioned in the evaluation criteria, and not depend upon reviewers' background knowledge.

SECTION VII -- APPENDIX A

**BUSINESS AND FINANCIAL APPLICATION PREPARATION INSTRUCTIONS
FOR SOLICITATION NUMBER:
DE-PS26-01NT41092**

This is the Proposal Coversheet for Volume I and shall be provided with the original and each copy of Volume I.

VOLUME I
BUSINESS AND FINANCIAL APPLICATION COVERSHEET
DE-PS26-01NT41092

Application No. _____
(For official use only)

Application Date: _____

Acceptance Days: _____

Application Title: _____

Company Name: _____

Address: _____

Point of Contact: _____

Telephone/FAX Number: _____

PROPRIETARY INFORMATION: Does this submittal contain Trade Secrets or Proprietary Information?

_____ NO

_____ YES (if yes, complete box below)

NOTICE OF RESTRICTIONS ON DISCLOSURE AND USE OF DATA

The data contained on pages _____ of this application have been submitted in confidence and contain trade secrets or proprietary information, and such data shall be used or disclosed only for evaluation purposes, provided that if this applicant receives and award as a result of or in connection with the submission of this application, DOE shall have the right to use or disclose the data herein to the extent provided in the award. This restriction does not limit the Government's right to use or disclose data obtained without restriction from any source, including the applicant.

**SECTION VII -- APPENDIX A -- BUSINESS AND FINANCIAL
APPLICATION PREPARATION INSTRUCTIONS
FOR SOLICITATION NUMBER DE-PS26-01NT41092**

7.1 GENERAL

1. Volume I, Business and Financial Application, consists of an application coversheet, application forms, assurances, budget pages, supporting cost data requirements, environmental questionnaire, other statements of the offeror, exceptions and deviations to the model cooperative agreement award, and any other business and financial information.
2. The application identified as the original shall contain all of the original signatures of all the documents requiring signature by the applicant. Use of reproductions of signed originals is authorized in all other copies of the application.
3. The applicant shall not provide application information in three-ring binders.
4. The Applicant shall provide a minimum cost share of 20 percent of the total estimated cost of the project (not 20 percent of the Government's share.)

7.2 FORMAT AND CONTENT

ALL FORMS NEEDED FOR PREPARATION OF VOLUME I ARE FOUND ON THE NETL HOMEPAGE AT: <http://www.netl.doe.gov/business/forms/forms.html>. PLEASE NOTE THAT ALL FORMS WERE DEVELOPED USING WORDPERFECT 6.1 AND FORMATTED FOR PRINTING USING A HP LASERJET IIIiSi PRINTER. INSTRUCTIONS FOR COMPLETION OF THE FORMS ARE CONTAINED ON THE BACK OF EACH FORM. QUESTIONS ON COMPLETION OF THE FORMS SHOULD BE ADDRESSED TO THE CONTRACT SPECIALIST.

Volume I shall include the following documents (in the order listed):

1. VOLUME I BUSINESS AND FINANCIAL APPLICATION COVERSHEET

The Application Coversheet for Volume I shall be provided with each copy of Volume I.

2. APPLICATION FOR FEDERAL ASSISTANCE Standard Form 424# -- **Form # SF424**
3. FINANCIAL ASSISTANCE ASSURANCE PACKAGE -- **Form #: assure.fa**
4. BUDGET PAGE(S)

The applicant must provide detailed budget information on one or more of the following budget forms. Non-Universities can use the 4600.4 or the 424.A. Universities should submit both the D4620.1 and the ERF4620. Supporting cost data for Universities shall be submitted as indicated by the instructions to the forms. For applicants other than Universities see the instructions below under Paragraph No. 5.

Applicants shall provide budget period costs and supporting cost detail by budget period and shall provide the total project costs for all budget periods. The budget period costs shall correspond to the Tasks to be Performed in the Statement of Project Objectives with a budget period ending at the DOE decision point and the next budget period beginning with month 13 or the next maturation stage.

Failure to provide the detailed cost information as described in the instructions will result in an incomplete package. If a minimum cost share is required by this solicitation, the applicant shall stipulate in the application the source and amount of cost sharing and the value of third party in-kind contributions proposed to meet the requirement.

- a. Federal Assistance Budget Information (for other than University Applicants) -- DOE F 4600.4 -- **Form #D4600.4**
- b. Budget Page DOE F 4620.1 (for University applicants) -- **Form # D4620.1**
- c. Grant Application Project Period Summary ER F 4620.1A (for University applicants) **Form #ERF4620**
- d. Budget Information -Non-Construction Programs (for other than University applicants) SF424a -- **Form #SF424a**

5. SUPPORTING COST DATA REQUIREMENTS

The following cost detail is required for the proposed cost elements. Additionally teaming members and subcontractors are also required to submit the below information with their budgets.

Personnel -- In support of the proposed personnel costs, provide a supplemental schedule that identifies the labor hours, labor rates, and cost by labor classification for each budget year. Also indicate the basis of the labor classification, number of hours, and labor rates. An example of the basis for the labor classification and number of hours could be past experience, engineering estimate, etc. An example of the basis for the labor rates could be actual rates for the individuals who will perform the work or an average labor rate for the labor classification or a departmental average rate.

Fringe Benefits -- Provide the method used to calculate the proposed rate amount. If a fringe benefit has been negotiated with, or approved by, a Federal Government agency, provide a copy of the agreement. If no rate agreement exists, provide the method used to calculate the proposed amount.

Travel -- For each proposed trip, provide the purpose, number of travelers, travel origin and destination, number of days, and a breakdown of costs for airfare, lodging, meals and incidentals. The basis for the airfare, lodging, meals and incidentals must be provided, such as past trips, current quotations, Federal Travel Regulations, etc.

Equipment -- Provide an itemized list of each piece of equipment, individual costs, and the basis for estimating the cost, for example, vendor quotes, catalog prices, prior invoices, etc.

Supplies -- Provide an itemized list of supplies, individual costs, and the basis for estimating the cost, for example, vendor quotes, catalog prices, prior invoices, etc.

Contractual -- Include in this category the cost of consultants and subcontractors in the same level of detail as the applicant's costs.

Consultants -- Provide the hourly or daily rate along with the basis for the rate. Furnish resumes or similar information regarding qualifications or experience. Provide at least two invoices reflecting hourly or daily rates charged to customers other than the Government. A statement signed by the consultant certifying his or her availability

and salary must be provided. If travel or incidental expenses are to be charged, give the basis for these costs.

Subcontractors -- Provide the total cost per year for each subcontractor. Detail of subcontractor's costs should appear in the subcontractor's budget explanation.

Construction -- Provide detail of construction costs, if applicable.

Other Direct Costs -- Provide an itemized list with costs for any other item proposed as a direct cost and state the basis for each proposed item.

Indirect Costs -- If indirect rates have been negotiated with or approved by a Federal Government agency, please provide a copy of the latest rate agreement. If you do not have a current rate agreement, submit an indirect cost rate proposal which includes the major base and pool expense groupings by line item and dollar amount. In either case, provide a breakdown of the proposed indirect costs for each of our accounting periods included in the proposal. Identify the rate and allocation base for each indirect cost, such as Overhead, General and Administrative, Facilities Capital Cost of Money, etc.

6. ENVIRONMENTAL QUESTIONNAIRE --**Form # nepasol**

7. ACKNOWLEDGMENT OF AMENDMENTS

The applicant shall specifically indicate their acknowledgment and receipt of the amendment(s) posted on the NETL Website at <http://www.netl.doe.gov/business/solicit/> by signing the amendment and including it in Volume I or stating the receipt of the amendment in the text of Volume I.

8. ADDITIONAL APPLICATION SUBMISSION REQUIREMENTS FOR FFRDC'S, DOE M&O CONTRACTORS OR LABORATORY ENTITIES

If your application includes work to be performed by an M&O contractor, the following additional information is required:

1. **Application and Field Work Proposal**: The application must include a SF 424, Application for Federal Assistance, and budget page for the applicant's portion of the project and a Field Work Proposal (See DOE Order 412.1 Work Authorization System) for the M&O portion of the project.

The application must also describe: 1) the portion of the project that will be conducted by the applicant and the portion that will be conducted by the M&O contractor and 2) the managerial arrangement between the applicant and the M&O contractor. The amount of work to be performed by the M&O contractors in the aggregate may not be greater than the aggregate amount of work to be performed by all other participants in the project, unless a higher level of participation is determined to be in the best interest of the government in advancing the objectives of the solicitation. DOE will review the application to determine that it meets this criteria and reserves the right to reject any application that fails to do so.

2. **Workscope**: The application must provide a scope of work for the effort to be performed by the applicant and a separate scope of work for the effort to be performed by the M&O contractor.

3. Authorization from the DOE Contracting Officer. The applicant must submit a document from the DOE Contracting Officer or authorized designee stating that the M&O contractor is authorized to participate in the proposed work effort (See Section VI - Conditions and Notices).

9. EXCEPTIONS AND DEVIATIONS TAKEN TO THE MODEL AGREEMENT

The applicant shall identify and explain any exceptions or deviations taken or conditional assumptions made with respect to the model cooperative agreement, the requirements of this Section, and any other matters associated with this solicitation.

Any exceptions taken must contain sufficient amplification and justification to permit evaluation. The benefit to the Government shall be explained for each exception taken. Such exceptions will not, of themselves, automatically cause an application to be termed unacceptable. A large number of exceptions, or one or more significant exceptions not providing benefit to the Government, however, may result in rejection of your application(s) as unacceptable.

10. SUMMARY OF EXCEPTIONS AND DEVIATIONS TAKEN IN OTHER VOLUMES

The offeror shall summarize each technical, cost, business, or other exceptions taken elsewhere, and provide specific cross references to its full discussion.

11. PROPOSAL SUPPLEMENTAL FORM

All applications are to include a completed Proposal Supplemental Form.

PROPOSAL SUPPLEMENTAL FORM

Project Title: _____

Need(s) Proposal Addresses (check all that apply):

- ☐ Lighting Technology ☐ Space Conditioning ☐ Building Envelope
☐ Water Heating and Appliances ☐ Whole Buildings

Prime Contractor Name and (Fed Ex) Address: _____

Congressional District: _____

Prime Contractor Business Type (check one):

- ☐ Small Business ☐ Large Business
☐ Educational Institution ☐ State/Local Government
☐ Non Profit Organization ☐ Other _____

Technical Point of Contact:

Name: _____
Address: _____

E-mail: _____

Phone: (Voice) _____
(Fax) _____

Subcontractors:

Business Point of Contact:

Name: _____
Address: _____

E-mail: _____

Phone: (Voice) _____
(Fax) _____

\$ Share: _____
\$ Share: _____
\$ Share: _____
\$ Share: _____
\$ Share: _____

Government Share of Total Proposed Project: _____

Recipient Share of Total Proposed Project: _____

\$ _____
\$ _____

(Minimum of
20% of total
project value)

Total Project Value: \$ _____

Total Project Duration (Months): _____

SECTION VIII -- APPENDIX B

**TECHNICAL APPLICATION PREPARATION INSTRUCTIONS
FOR SOLICITATION NUMBER:
DE-PS26-01NT41092**

This is the Proposal Coversheet for Volume II and shall be provided with the original and each copy of Volume II.

VOLUME II -- TECHNICAL APPLICATION COVERSHEET
Energy Efficient Building Equipment and Envelope Technologies
DE-PS26-01NT41092

Proposal No. _____
(For official use only)

Proposal Date: _____
Acceptance Days: _____

Need Area: _____
Proposed Title: _____

Company Name: _____
Address: _____

Point of Contact: _____
Telephone/FAX Number: _____
Principal Investigator: _____
Telephone Number: _____

PROPRIETARY INFORMATION: Does this submittal contain Trade Secrets or Proprietary Information?

_____ NO _____ YES (if yes, complete box below)

NOTICE OF RESTRICTIONS ON DISCLOSURE AND USE OF DATA

The data contained on pages _____ of this application have been submitted in confidence and contain trade secrets or proprietary information, and such data shall be used or disclosed only for evaluation purposes, provided that if this applicant receives an award as a result of or in connection with the submission of this application, DOE shall have the right to use or disclose the data herein to the extent provided in the award. This restriction does not limit the Government's right to use or disclose data obtained without restriction from any source, including the applicant.

8.1 FORMAT AND CONTENT -- VOLUME II TECHNICAL PROPOSAL

In order to produce a comprehensive proposal for this solicitation, the applicant is required to address, at a minimum, the areas listed below. To help facilitate the review process and to insure addressing all the review criteria, the applicant shall use the following Table of Contents when preparing the technical proposal.

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8.2 STATEMENT OF PROJECT OBJECTIVES AND NEEDS AREAS

1. PROJECT BACKGROUND

The United States consumes roughly 94 quadrillion Btus (quads) of primary energy per year. The Nation's 80 million homes and commercial buildings consume 36% or 34.2 quads of this total. Buildings also use two-thirds of all electricity generated nationally. More than \$230 billion is spent each year in the U.S. to provide heating, cooling, lighting and related energy services for buildings. Even if the energy intensity of buildings remains constant, as more buildings are constructed, energy consumption and associated economic and environmental costs will continue to escalate. Energy consumption in buildings is a major cause of acid rain, smog, and greenhouse gas emissions in the United States, representing 35% of carbon dioxide emissions, 48% of sulfur dioxide emissions, and 21% of nitrogen oxide emissions.

One of the primary challenges to achieving efficiency in the building sector is the fragmentation of the industry. The building industry encompasses literally thousands of different businesses and millions of individual decision makers. Developers, designers, builders, utilities, engineers, and occupants pursue objectives which often are at cross-purposes. Also, unlike the transportation sector that is dominated by a few major firms responsible for final assembly and product delivery, the building sector has hundreds of thousands of builders who put together individual components into complete structures. As a result, product integration is less than optimal and the number of decision makers that must be influenced to achieve change is much greater. This is a risk-averse industry that has been slow to adopt new technologies and embrace change.

Another consequence of this fragmentation is that the building industry spends relatively little on research and development. The industry is dominated by small firms that can ill afford research programs, and competition between small business firms effectively prevents coordinated or integrated research. Research and development expenditures for the buildings sector as a whole are an order of magnitude less than the national average. Given the importance of current energy consumption and projected growth in the buildings sector, maintaining and growing a vital research program for efficient and affordable buildings is critical to the success of the Department's overall strategic goal of increasing the efficiency and productivity of energy use.

Research by the Department in the buildings area fills three needs. First, the Department can provide the critical mass necessary to accelerate progress in an area under limited investigation by the private sector. Second, in many cases, important research would not occur at all in the absence of the Department's efforts due to the fragmented nature and short-term focus of the buildings industry. Third, it provides industry with objective analysis on new technologies and techniques to reduce barriers to new technology adoption.

The Department's buildings R&D portfolio is undergoing a fundamental change. In the spring of 1997 it was recognized, with Congressional concurrence, that there was a need for broader industry input, increased competition and less fragmentation and greater focus in the portfolio. The Office of Building Technology, State and Community Programs (BTS), which manages the bulk of the buildings research done by the Department, initiated a strategic planning process that is realigning the research in this sector.

As a critical part of the realignment process, the DOE Office of Building Technology, State and Community Programs (BTS) is facilitating an industry-led effort to develop a series of technology road maps for various sectors of the building industry. Road

mapping creates a shared vision among diverse groups within each sector and provides a framework for cooperative technology development efforts and market transformation activities. It also serves to align government R&D resources with the high-priority needs identified by industry.

The technology development portions of the road maps serve as a guideline for focusing the statement of needs for this solicitation. BTS-facilitated industry road maps are currently available for three sectors: lighting, windows and commercial buildings. A fourth BTS-industry road map on building envelopes is nearing completion. BTS also recognizes an industry-developed road map for heating, ventilating and air-conditioning (HVAC) developed by the Air-Conditioning and Refrigeration Institute. In addition, BTS is participating in the road mapping efforts for the Presidential initiative Partnership for Advancing Technology in Housing (PATH). PATH covers a wide scope of issues in housing, including durability, affordability, disaster resistance, worker safety as well as energy efficiency.

This solicitation is the third in as many years focusing on research and development in the building sector. However, because of an organizational and budgetary realignment within DOE's Office of Energy Efficiency and Renewable Energy (EERE), several BTS tasks have been assigned to the EERE Office of Power Technologies. Thus, the scope of this solicitation is narrower than in previous years. This solicitation specifically excludes the following generic categories of equipment, technologies and market sectors: 1) fuel-fired (e.g., oil and natural gas) furnaces and boilers for space heating, 2) fuel-fired heat pumps, chillers and air-conditioners, 3) fuel-fired on-site electric generation of any sort, including fuel cells and internal combustion engines, and associated heat recovery or building integration systems, 4) any system using a fuel-fired prime mover (heat engine) such as engine-driven air-conditioning and/or heat pump systems and 5) desiccant systems other than total enthalpy exchange devices (e.g., ventilation total energy recovery systems).

References:

Information about advanced building technologies, systems, and partnership opportunities that promote energy efficiency, renewable energy, and pollution prevention is at URL <http://www.eren.doe.gov/buildings/>.

Technology road maps and supporting documents are available at URL http://www.eren.doe.gov/buildings/technology_roadmaps/

The latest information on the yet to be completed PATH roadmap can be found at www.PATHNET.ORG

Information on Financial Assistancet regulations can be found at URL <http://www.netl.doe.gov/business/index.html>.

2. STATEMENT OF NEEDS

1.0 WHOLE BUILDINGS

Traditionally buildings are designed and built by building disciplines (architects, engineers, contractors, consultants) working independently—resulting in buildings that are a collection of technologies (components, systems, and equipment) rather than an integrated whole. Through a whole building (or “systems engineering”) approach, all of the building components and subsystems are considered together along with their potential interactions

and impact on building occupants and building operating performance. The goal of this approach is to capitalize on opportunities to improve performance (such as energy or indoor environment) while mitigating or eliminating negative interactions among subsystems. The whole building approach can greatly improve energy and resource efficiency while improving the indoor environment, thus it is a key component in the developing field of high performance buildings.

1.1 Building Performance

The Road Map for Commercial Buildings identifies the need for core definitions and metrics for high-performance commercial buildings. There is a need to develop measurable, defensible and reproducible metrics for energy, economic, indoor environment, occupant productivity, and other elements of whole-building performance. Such metrics will support marketing the positive benefits of high-performance buildings--replacing the largely anecdotal evidence available presently. In addition, a better understanding is needed of the fundamental physical processes that govern overall building performance as well as interaction of occupants and building systems. Physical processes include: 1) thermal, fluid, and mass flow, 2) indoor contaminant emissions including propagation and mitigation, and 3) component, equipment, and process interaction. One example of research work in this area would be the development , demonstration and validation of computer based modules to be incorporated into existing platforms such as EnergyPlus.

1.2 Controls

There is a need to develop technologies and intelligent systems that allow a building to monitor the status of its components, equipment, and systems and then optimally operate its energy-consuming systems. This includes development of low-cost solid-state wireless monitoring/communications for building performance throughout the building and "self-learning" building management systems with active operator guidance and training feedback. The goal of this task is to allow real-time monitoring and control of energy, indoor air quality, comfort, and pollutants after the building is commissioned.

2.0 LIGHTING TECHNOLOGY

Lighting in residential and commercial buildings accounts for 15% of the total energy used and 23% of the electricity consumed in the buildings sector. The potential exists to reduce lighting energy use by 50 percent by 2010 with new technology. To realize the potential, advances are needed in three areas: (1) advanced light source and ballast technologies; (2) luminaires, controls, and distribution systems; and (3) lighting impacts. These areas are also identified in the Lighting Road Map as key strategies and activities for achieving industry's long-term vision for lighting.

2.1 Light Sources:

Lighting energy consumption can be significantly reduced by increasing the efficiency of light production. To increase efficiency, there is a need to advance the science and engineering of all types of light sources including incandescent, fluorescent, high-intensity discharge and solid state types. A better understanding is needed of the basic science of light production and of the physical processes that limit energy efficiency. Improvements in light source materials, processes, components, electronics, and systems are needed. Completely new light source technologies need to be established as viable, energy efficient, and cost effective alternatives to conventional

technologies. One goal is to develop potential replacements for the inefficient incandescent lamp.

2.2 Luminaires, Controls, and Distribution Systems:

Opportunities exist to greatly reduce lighting energy consumption by delivering light more efficiently to end users and increasing the use of daylighting. Advances are needed in several areas, including: (1) luminaire materials and optics; (2) light collection, management, and distribution components and systems; and (3) advanced means for controlling delivered light in response to occupancy, daylight availability, and user needs. Opportunities also exist to integrate advanced lighting control technologies with other building systems such as HVAC, communications and security to reduce energy consumption.

2.3 Lighting Impacts:

Energy savings may also arise from optimizing the amount and type of delivered light for the purposes required. Optimizing delivered light is difficult since lighting impacts the way users interact with their environment in many complicated and little understood ways. Therefore, a more scientific understanding is needed of the relationship of light to human needs, especially the linkage between lighting characteristics and visual task performance and the likely impact of lighting on productivity and user acceptance.

3.0 SPACE CONDITIONING EQUIPMENT

The equipment and systems used to provide thermal comfort and adequate indoor air quality for residential and commercial buildings consumes 39% of the total energy used in buildings. Significant reductions in energy use can be achieved by increasing the efficiency of this equipment, by distributing thermal energy more efficiently and by more closely meeting the needs of building occupants.

3.1 Energy Conversion Efficiency:

While some types of heating and cooling equipment have improved significantly in terms of rated energy efficiency in the recent past, there is still a need for advanced materials, components and system designs to provide additional gains in rated efficiency. However, even the most highly energy efficient equipment frequently suffers from significant performance losses in the field from installation deficiencies, operational effects and long-term degradation. (For example, for unitary air-conditioners and heat pumps, performance losses in the field primarily arise from incorrect refrigerant charge, improper indoor air flow and overcapacity.) Research is needed to characterize these field performance losses and new technology is needed to minimize these losses and to facilitate proper installation, commissioning and performance monitoring for all types of equipment. There is also a need for improved technology for cost effectively controlling humidity and improving indoor air quality through ventilation or filtering while reducing overall energy consumption. There is a need for a greater understanding of the basic processes involved in energy conversion, heat and mass transfer and other phenomena which influence space conditioning equipment efficiency and effectiveness.

3.2 Distribution, Storage, Control, and System Integration:

In contrast to energy conversion equipment, there has been less improvement in thermal energy distribution, storage and control systems in terms of energy efficiency and peak load reduction potential. For example, duct system designs, insulation materials and installation practices are a major source of system inefficiency nationally and often negate the benefits of high efficiency air-conditioning units. In many cases, systems operate most inefficiently during times of peak electric demand, thereby exacerbating electricity supply problems. Technology is needed to reduce losses in distribution systems, including an increase by a factor of 3 to 5 in insulation effectiveness in ducts contained in unconditioned spaces. Advancements are also needed to improve thermal storage systems, improve control systems, reduce system auxiliary and parasitic energy use and improve systems integration from a whole buildings perspective while meeting occupant comfort and performance requirements. Therefore, greater knowledge about the nature of energy losses and system interactions is needed, in addition to new components and systems, to reduce losses.

4.0 BUILDING ENVELOPE

Building envelopes consist of the windows, walls, roofs, foundations, and other elements which comprise building exteriors and/or enclose conditioned spaces. Building envelopes are the primary factor governing the heating, cooling, and ventilation requirements of buildings and also influence electric lighting requirements. Thus, building envelopes influence 53% of building energy use.

Substantial energy savings can be achieved through improvements in the materials, components, and systems which make up building envelopes. There is a need for improved envelope performance in terms of heat losses and gains, infiltration, moisture control, daylighting availability, etc., through advanced component technology, systems integration and an improved understanding of the basic processes governing envelope performance. There are opportunities for energy savings through integrating photovoltaic (PV) technology into building envelope components.

4.1 Building Materials and Envelope Systems:

Advanced insulation materials are needed to increase thermal performance, while satisfying constraints due to durability, cost, dimensional limits, and environmental, safety, and health concerns. Improved foundation, wall, and/or roof components or systems are also needed to cost effectively provide increased thermal performance, infiltration integrity, and moisture control and reduced environmental impact. Integrated PV-envelope components and systems are needed to reduce PV installed costs and improve the overall energy performance of buildings. A better understanding is needed of the basic heat and mass transfer processes governing the energy performance of envelope systems. For example, fundamental research is needed on hygrothermal properties and the effects of moisture on thermal performance and durability of building materials. Development is needed of materials, including additives and coatings, that are both waterproof and breathable, resisting rain but allowing water vapor to escape for self-drying of the building envelope materials.

4.2 Windows:

Priorities for window and glazing technology needs are broadly addressed in the Window Road Map. Among these priorities, there is a need for advanced window systems and advanced glazing materials and deposition processes including material and process technologies for chromogenic and spectrally selective glazing. Examples of advanced window systems might include high thermal performance vacuum glazing, and low-cost retrofit technologies. There is a need for alternative chromogenic technologies with better properties and improved manufacturability compared to the electrochromic technologies now being developed. For spectrally selective glazing, new materials and advanced processing techniques are needed to improve deposition rates and to improve product optical and electrochemical properties, durability, and cost. In addition to advanced glazing technologies, new approaches are needed to accurately and economically measure the performance of high performance window products and components for controlling production quality, for evaluating units in inventory or in the field and for determining durability. There is a need for a public domain technology base on the durability of Insulating Glass units, which could support the development of durability performance standards. The Road Map further identifies the need to develop strategies and hardware necessary to optimize integration of the window with the rest of the building, potentially including thermal, light transmission, structural, power generation and data interconnections.

5.0 APPLIANCES

The appliances category consists of all energy using equipment not used for space conditioning, lighting or power generation in both residential and commercial buildings. A very wide variety of equipment is covered in this category (water heaters, refrigeration equipment, consumer and commercial cooking and laundry appliances, electronic equipment, etc.). Residential and commercial appliances consume approximately 28% of the energy used in buildings. Most types of equipment are partly covered by DOE's minimum efficiency standards. These standards have been a major factor in greatly increasing appliance efficiency in the residential sector. However, high efficiency product options are currently not available for some categories of residential appliances, commercial appliances are largely not covered by standards and standards do not apply to integrated appliances. New technologies are needed to cost-effectively attain efficiency levels well beyond current or proposed standards and to improve the energy efficiency of appliances not covered by minimum efficiency standards, particularly in the commercial sector. There is also an emerging technical opportunity in a need for energy-efficient "smart appliances" and appliance networking, in which appliances and other building equipment are interconnected or networked through data and control infrastructures to achieve energy savings, load management and user convenience benefits.

5.1 Water Heating:

Water heating accounts for 12% of the total energy consumed in buildings. Currently, the average efficiency of water heating is relatively low compared to thermodynamic limits. Therefore, there is considerable opportunity to reduce energy use overall in the buildings sector by improving the efficiency of water heating and/or hot water delivery system efficiency. Advances are needed in cost-effective components and system designs for both single-purpose water heaters and multi-purpose, integrated water heating systems using both fossil fuels and electricity for residential and commercial applications. Specifically, there is a need to develop technology for cost-effective electric heat pump water heaters appropriate for widespread use. There is also a need to develop fail safe, cost-effective technology that will reduce the standby losses and/or increase the recovery efficiency of gas

or oil-fired residential water heaters. There is also a need to develop a low-cost, high-R insulation for all types of residential and commercial water heaters.

5.2 Commercial Refrigeration:

Commercial refrigeration consists of a wide variety of equipment ranging from stand-alone, self-contained vending machines to large supermarket systems consisting of multiple display cases and walk-in units using remote parallel compressors and condensers. This type of equipment accounts for 3% of the total energy consumed in buildings. Energy efficiency standards or energy labeling generally does not exist for these products. In addition, new FDA requirements for keeping food temperature at a safe level, especially for refrigerated meat products, is expected to increase energy use over the current levels. There is a need to develop and demonstrate component and control technologies and new designs for merchandising units (e.g., supermarket display cases) that result in a significant reduction in energy use while meeting product temperature limits with no impact on merchandising effectiveness.

5.3 Other Appliances:

Major advancements are needed in component technologies, particularly those which apply to a wide variety of product types. For example, advanced appliance insulation materials are needed to increase appliance thermal performance, while satisfying constraints such as durability, cost, user acceptance, size limits, and environmental, safety, and health concerns. There is a need also to accelerate the development of innovative system designs, improved controls and integrated or networked appliances, particularly for appliance categories not covered by minimum efficiency standards and those for which high efficiency product alternatives do not exist. Example product categories include advanced clothes dryers, electronic equipment (computers, office equipment, telecommunications, etc.) and commercial appliances in general.

8.3 TECHNOLOGY MATURATION STAGES

Many of the needs identified in the Statement of Project Objectives, Section 8.2, are described in terms of technology products. Similarly in this section, the stages of maturity for a given technology are also described in product terms. Such descriptions are not meant to indicate that only projects which directly result in a marketable product are sought in this solicitation. Progress towards meeting many of the needs in Section 8.2 can be made by advancements in enabling technology or basic knowledge and information. For the purposes of this solicitation, research to produce generic technology, knowledge and information is considered to be applied research as defined in this section.

The technology maturation stages eligible for this solicitation are Stages 2-5, and each stage is defined below:

Technology Maturation Stage 2 - Applied Research

Scientific principles are demonstrated, a need is identified and the technology shows potential advantages over commercially available, consumer preferred technologies. For enabling technologies there is a clearly identified mechanism, or path, for technology transfer to product(s). In the case of basic knowledge and information, there is a need identified and the research offers potential improvements over the current knowledge-base.

Technology Maturation Stage 3 - Exploratory Development

Offeror has a product concept and addresses a priority Energy Efficiency need. Technology must show potential advantages over commercially available, consumer preferred technologies and technical feasibility is shown through limited, component bench-scale testing. Offeror must also demonstrate knowledge of similar technology research and development activities taking place within other Federal agencies, universities, industry, or international organization.

Technology Maturation Stage 4 - Advanced Development

Offeror has conducted bench/laboratory scale tests to move product concepts into laboratory scale prototypes capable of accomplishing a specific application. Technology must show clear advantages over commercially available, consumer preferred technologies, and alternative technologies.

Technology Maturation Stage 5 - Engineering Development

Offeror refines the prototype system to test design features and performance limits, constructs a fieldable prototype/system and performs field testing in a representative or actual application or setting.

8.4 PUBLIC ABSTRACT (OCT 2000)

This section shall contain a concise public abstract of not more than one (1) typewritten page clearly stating the objectives of the proposed research, the title of the project, methodology, and sponsoring organization (s). The abstract is to provide an overview of the proposed project objectives. It is a stand-alone document. This abstract may be released to the public by DOE in whole or in part at any time. It is, therefore, required that it shall not contain proprietary data or confidential business information. The offeror shall indicate a point of contact for coordination, preparation and distribution of press releases.

8.5 GENERAL INFORMATION

The application shall not merely offer to perform work in accordance with the Statement of Project Objectives but shall describe the actual work proposed.

The Technical Application shall not exceed 30 single-sided pages. The statement of project objectives, resumes, additional pertinent publications and the technical exceptions and deviations are to be attachments to the application and will not be included in the 30 page limitation. Pages in excess of the 30 page limitation may be removed from the application prior to evaluation. The proposed text shall be typed, single spaced, using Elite size (12 pitch) type (or computer font equivalent) and printed, unreduced on size 8 1/2-inch by 11-inch paper. Illustrations shall be legible and no longer than 11-inch by 17-inch fold-outs, as appropriate for the subject matter. Each 11-inch by 17-inch fold-out is considered two pages when determining the number of pages. Pages of each volume shall be sequentially numbered with the volume and page numbers on each page. Except as otherwise noted in the solicitation, the page guidelines previously set forth constitute a limitation on the total amount of material that may be submitted for evaluation. No material may be incorporated in any application by reference as a means to circumvent the page limitation.

All measurements described in the application shall be expressed in the metric (SI) system with the United States Customary Units (USCU) in parentheses. Additionally, applicants are hereby notified that any instrumentation associated with tasks which will be performed will be required

to be in the SI system with USCU in parenthesis and all technical reporting will require information in the SI system with USCU in parenthesis.

The applicant shall organize the Technical Discussion as follows:

1. Technical Merit
 - 1.1. *****
 - 1.2. *****
 - 1.3. *****
2. Energy, Environmental and Economic Benefits
3. Applicant and Participant Roles and Capabilities
4. Industrial Involvement and Commercialization Potential

Topics 1, 2, 3, and 4 each correspond to one of the Technical Evaluation Criteria. The applicant should provide as much detail as practical in each part while providing, as a minimum, the information requested below. The applicant's discussion of each area should clearly address the technical evaluation criteria for that area.

8.6 TECHNICAL MERIT (CRITERION 1)

- The applicant shall provide a detailed discussion of the need or problem the technology or product will address and the major issues and key risks in the development of the proposed technology. The applicant shall also provide a detailed discussion to validate that the proposed technology or product is technically superior to currently available products.
- The applicant shall provide a detailed discussion of the proposed approach to technology or product development given the current development status of the technology, and overall impact of successful project completion to future success in the marketplace. The applicant shall also provide a detailed discussion to prove the feasibility of the proposed technology or product, the scientific merit (based on sound scientific and engineering principles), and the degree to which the technology or product is innovative and unique.
- The applicant shall provide a proposed work plan and schedule and include milestones and performance metrics in the work plan to gauge technical progress. The applicant shall provide a PERT (Program Evaluation and Review Technique) chart or equivalent depicting the project schedule, milestones, and interrelationship of the project tasks. The applicant shall identify the critical path which identifies the sequential tasks which, if not completed on time, will result in a delay in the overall project schedule. All significant milestones shall be defined in a milestone log and depicted on the schedule.
- The applicant shall provide a table listing the estimated labor hours and labor categories (e.g., project manager, principal investigator, engineering, technician, scientific, clerical) required for each task and shall provide totals for each maturation stage. The applicant shall include a table showing labor hours and labor categories for any proposed subcontracting or consulting effort for each task. The applicant shall discuss the rationale used to develop estimates for labor hours, labor categories, subcontracting effort, consulting effort. Cost information is not to be

included in the technical proposal volume. The applicant shall explain the purpose of the subcontract or consulting effort.

8.7 ENERGY, ENVIRONMENTAL, AND ECONOMIC BENEFITS (CRITERION 2)

- The applicant shall provide evidence of significant energy benefits and technical performance expected from the proposed technology or product. Energy savings potential shall be determined according to the guidelines contained in Section IX -- Appendix C.
- The applicant shall provide evidence of significant environmental benefits from the proposed technology or product. Environmental benefits include, but are not limited to: reduced global warming potential, increased protection of the stratospheric ozone layer, lower direct releases of water, air and ground pollutants, improved indoor air quality, improved recyclability and beneficial human health impacts. Potential reductions in emissions of carbon dioxide from the proposed technology shall be determined according to the guidelines contained in Section IX -- Appendix C.
- The applicant shall provide evidence of significant economic market potential for the proposed technology or product. For enabling technologies the applicant shall describe the mechanism, or path, for technology transfer to product(s). In the case of basic knowledge or information, the applicant shall identify the need and provide evidence of potential improvements over the current knowledge-base.

8.8 APPLICANT AND PARTICIPANT ROLES AND CAPABILITIES (CRITERION 3)

- The applicant shall provide a detailed discussion of current corporate experience and success in similar projects resulting in successful technology development and commercialization or technology transfer to commercial product(s). In the case of basic knowledge or information, the applicant shall provide a detailed discussion of corporate experience and success in similar projects, including transferring information to practical uses by government or industry.
- The applicant shall provide a detailed discussion of experience and availability of key personnel to complete the proposed project. Relative to the nature and time scale of the proposed project, team capabilities shall be evaluated for both technical expertise and, if needed for the success of the project, product commercialization and/or technology transfer expertise. For key personnel which are not staff members of the applicant's organization, the applicant shall provide evidence of the availability of such personnel, consistent with their role in the proposed tasks, to validate the overall team experience being proposed.
- The applicant shall provide a detailed discussion of adequacy (quality, availability and appropriateness) of facilities and equipment to accommodate the proposed project. The applicant shall identify any major equipment needed for the proposed project which will need to be acquired during the course of the project.

8.9 INDUSTRIAL INVOLVEMENT AND COMMERCIALIZATION POTENTIAL (CRITERION 4)

- The applicant shall provide a discussion of the commercialization strategy for the proposed technology or product and of the intellectual property rights and/or institutional alliances to execute the commercialization strategy. For

enabling technologies the applicant shall provide a discussion of the strategy for technology transfer to commercial product(s). In the case of basic knowledge or information, the applicant shall provide a discussion of the strategy for transferring the information to practical uses by government or industry.

- The applicant shall provide a detailed discussion of the viability and practicality of the proposed technology, product or information to meet the needs of the target market in a cost effective manner without major market restructuring considering potential technical, regulatory, economic, environmental, production or other issues impacting market success.
- The applicant shall provide a detailed discussion of the corporate commitment to the proposed project by exceeding the minimum required cost share and/or providing in-kind contributions to enhance commercialization potential.

8.10 INSTRUCTIONS FOR PREPARING STATEMENT OF PROJECT OBJECTIVES

THE STATEMENT OF PROJECT OBJECTIVES SHALL BE LIMITED TO FIVE (5) PAGES IN TOTAL AND SHALL BE INCLUDED AS APPENDIX A. The following is the format in which the Statement of Project Objectives shall be prepared:

Title of Work to Be Performed:

Insert title of work to be performed. Be concise yet descriptive (e.g., "Development of Highly-Reflective Low-Slope Roof Coatings").

A. Objectives:

Include one paragraph on the overall objective(s) of the work. Also, include objective(s) for each technology maturation stage.

B. Success Criteria:

This section must describe the specific criteria the offeror must satisfy to go to the next technology maturation stage.

C. Scope of Work:

This section shall not exceed 1/2 page and shall define the effort which will take place and the methodology to achieve the objective of the work.

D. Tasks to be Performed:

Detailed tasks, concisely written, shall be provided in a logical sequence and must be divided by "go/no-go" DOE continuation decision points according to the technology maturation stages eligible for this solicitation, i.e., Technology Maturation Stage 2 - Applied Research, Technology Maturation Stage 3 - Exploratory Development, Technology Maturation Stage 4 - Advanced Development, and Technology Maturation Stage 5 - Engineering Development. All project tasks shall be consecutively numbered and titled. A DOE continuation decision point shall be included at the end of each maturation stage, where DOE will make an assessment of the progress and determine if continuation of the effort is warranted. Should the activity in any maturation stage exceed 12-months in duration, DOE continuation decision points shall be established for that maturation stage at no less than every 12-months and at the end of the maturation stage. Proposed projects can begin at any one of the maturation stages identified above. Where a product/system is being proposed, the Statement of Project Objectives should contain tasks leading to the successful completion of Maturation Stage 5. However, if that is not possible within the time and funding constraints of this solicitation, the applicant should describe how the proposed project supports eventual attainment of maturation stage 5 and commercialization. A proposed Statement of Project Objectives to achieve a better understanding of the science of energy and energy efficiency is considered to be applied research for the purposes of this solicitation.

E. Deliverables:

Provide a listing of deliverables other than those identified in the Reporting Requirements Checklist contained in Attachment B of the model cooperative agreement.

F. Briefings:

The following briefings shall be included in the Statement of Project Objectives and shall be planned for in the cost proposal.

The Recipient shall prepare detailed briefings for presentation to the Contracting Officer's Representative (COR) at Morgantown, West Virginia. The briefings shall be given by the Recipient to explain the plans, progress, and results of the technical effort. The first briefing shall be presented within 30 days after agreement award. Additional briefings shall be presented at least 45 days before a continuation decision point. The final briefing shall be presented at least 45 days before the award is due to expire.

8.11 TECHNICAL EXCEPTIONS AND DEVIATIONS (JULY 1999)

This section shall identify and explain any exceptions or deviations taken or conditional assumptions made with respect to the technical requirements of the solicitation.

Any exceptions taken must contain sufficient amplification and justification to permit evaluation. All benefits to the Government shall be explained for each exception taken. Such exceptions will not, of themselves, automatically cause an application to be termed unacceptable. However, a large number of exceptions, or one or more significant exceptions not providing benefit to the Government may result in rejection of the application(s) as unacceptable.

SECTION IX -- APPENDIX C

Guide for Evaluation of Energy Savings Potential

**Office of Building Technology,
State and Community Programs (BTS)**

February 3, 2000

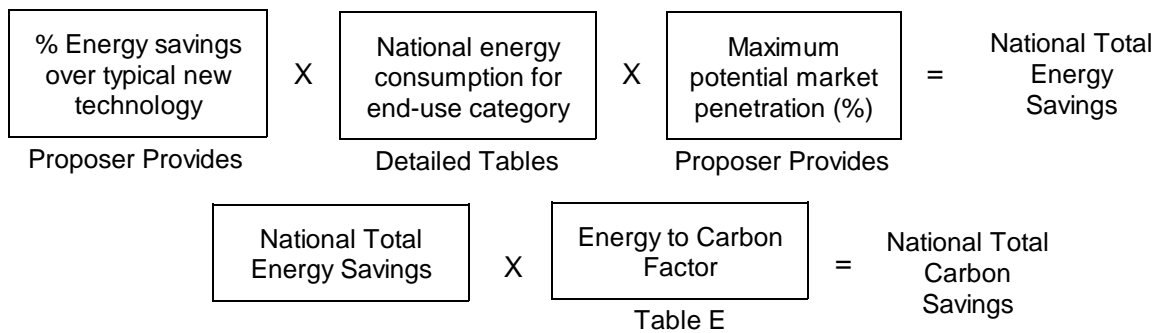
Introduction

This guide provides a method for estimating the savings in primary energy consumption and carbon emissions resulting from technology changes in buildings. The objective of the estimation method is to facilitate comparison of a wide variety of building technologies on a common basis. This guide specifically provides the method's simple calculation framework and generic supporting data.

The method is applicable to technologies for end-use equipment and building envelopes for both residential and commercial buildings. The method can accommodate technologies which are at the very early stages of development as well as well-characterized technologies in the midst of the development cycle. To accommodate the wide range of technologies and to reflect major market opportunities, the method incorporates slightly different approaches for building equipment technologies and building envelope technologies.

The method provides savings estimates which highlight the relative differences among technologies. It may or may not provide an accurate forecast of the likely impact of any specific technology. The estimates of savings are expressed in terms of an annual national rate, based on the maximum likely market penetration for the proposed technology.

A straightforward savings calculation method that will accommodate most technologies and markets is displayed below in the "linked boxes" format.



The method requires four basic data items to generate an estimate of both primary energy savings and carbon emission savings. Those items and their sources are:

- | | |
|---|-------------------|
| 1. Primary energy consumption of the end use(s) targeted | Attached Tables |
| 2. Performance level of typical new technology or product | Attached Tables |
| 3. Performance level of proposed technology | Proposer provides |
| 4. Expected market penetration of proposed technology | Proposer provides |

Items 1 and 2 above are provided in Tables A through D, covering residential and commercial buildings. Table E provides data to convert energy savings into carbon emissions savings, along with selected conversion constants, to insure consistency.

Items 3 and 4 above are provided by the proposer and must have adequate supporting justification. The performance level (item 3) must be based on the attributes of the proposed technology and must be supported by appropriately detailed engineering or scientific analysis, building simulation modeling, and/or literature references. These data are necessary to justify the performance level used.

In many cases, the technology proposed will be a sub-component of the elements listed in Tables A through D. Sub-component technologies will require some calculations prior to Step 1 of the methodology. Example #2 deals with this situation. Proposers must provide sufficient information to explain and justify estimates of system improvements based on improved sub-component technologies.

The methodology is based on comparing the performance level of the proposed new technology with the performance of the typical new technology currently used. In a replacement situation, it is implicitly assumed that replacement would occur in any case. Therefore, the comparison is not based on the performance of the technology actually being replaced, but on the technology most likely to be used today.

The expected market penetration (item 4) is an estimate of the long-term penetration of the target market, on a percentage basis. The expected market penetration must be supported by a brief market analysis and/or supporting literature references. The market analysis needs to consider economic factors (including expected first cost and payback period, relative to other technologies) and non-economic factors which may limit the penetration of all of the target market. (Non-economic factors include product physical size, building characteristics and institutional barriers.) A discussion of these factors may be necessary to justify the market penetration level used.

It is possible to save energy with a technology which does not exceed the maximum efficiency levels currently available in the market, but has lower first cost than current high-efficiency products. (An example would be new technology for natural gas condensing furnaces with 92% AFUE and inherently lower manufacturing cost than current condensing furnaces.) The low-cost technology will create an incremental or additional market penetration above the present sales level for highly-efficient products. This incremental market penetration is used in calculating savings.

The savings calculation method outlined herein, if applied directly, may not accurately estimate the savings for certain technologies (such as fuel-switching, cross-cutting, integrated technologies) or niche applications. For these special cases, the proposer may modify this methodology or create a parallel methodology, as long as the methodology provides a comparable level of calculation transparency, contains adequate justification through supporting data, and is fully consistent with the data in Tables A through E. The savings are to be in terms of an annual national rate at the maximum likely market penetration, not cumulative savings over several years nor a savings rate at future point in time.

Equipment Technologies

The approach for estimating the relative energy savings of building equipment technologies is based on the normal replacement of equipment in the existing stock of buildings. The current energy consumption characteristics of existing buildings (Tables A and C) are used as the baseline for market penetration and savings estimates. This method implicitly uses the following approximations:

- all energy-consuming equipment in all current buildings will eventually be replaced with new equipment, either due to wear-out or functional or economic factors.
- over the next 20 years, replacement of equipment in existing buildings is a much larger market for energy savings than installations in newly-constructed buildings.

Therefore, there is no need to forecast the energy consumption characteristics of building equipment in the future. Nor is there a need to calculate energy savings potential in new construction. Sufficient differentiation among equipment technologies is achieved using the energy use characteristics of existing buildings.

Example #1 This example deals with technology advances for heat pump water heaters. The target market is residential electric water heating. For the expected market penetration, the example estimates that 30% of the residential electric water heater stock has the potential of eventually being replaced by the heat pump water heater. This penetration level reflects the influence of several factors including: the cost of

electricity, the first cost differential relative to competitive products, the proportion of homes with higher hot water use and installation constraints.

Envelope Technologies

In contrast to the situation for building equipment, many new technologies for building envelopes may find their primary market in newly-constructed buildings. Retrofit of existing buildings may represent only a secondary market. Therefore, to best estimate the relative energy savings of building envelope technologies, an estimate of energy savings in both new and existing building markets may be needed. Table B and D provide data on the energy consumption characteristics of both existing buildings and new construction. For new construction (Table B2 and D2), the tables provide ten-year cumulative energy consumption based on current 1990s construction characteristics and forecasted construction rates over the next ten years. These data sets provide a relative basis for accounting for both the retrofit and new construction markets for envelope technologies.

To estimate the percent energy savings for an envelope technology, the proposer estimates the performance level of the proposed technology relative to the typical performance level of current technology. The tables do not provide performance data for current envelope technologies used in new buildings or in retrofit of existing buildings. The proposer will need to supply these data. These performance levels require justification, either by building modeling results, field measurements, literature references, etc.

The energy consumption baseline for new construction consists of the cumulative energy consumption of ten years of new building construction. This baseline is used to determine relative energy savings regardless of the expected market entry date of the technologies (i.e., even if the technology will not enter the market until late in the 2000 decade or beyond). The calculation method is to provide a relative energy savings estimate appropriate for comparing various envelope technologies, not to accurately predict future savings. If the technology is expected to be used in both existing buildings and new buildings, the proposer will have to estimate market penetrations for both. The market penetrations are justifiable estimates of the ultimate market penetration, whether or not that level of penetration is likely to occur before 2010 or within ten years after market introduction.

Example #2 This example deals with a new insulation technology for building exterior walls. To use the method, the performance level of the proposed wall insulation must be translated into a percent energy savings for the entire wall system. Since there are several heat transfer mechanisms involved in building exterior walls, the translation is generally not a simple one. Thus, Step 1 would need to be supplemented with additional data or calculations to support the estimate of percent energy savings for the wall system.

List of tables

Table A: Residential End Use Primary Energy Consumption and Equipment Efficiencies - Current Building Stock

Table B: Residential Space Conditioning Energy Consumption by Envelope Component
B1 - Current Building Stock
B2 - Ten Years of post-2000 New Construction

Table C: Commercial End Use Primary Energy Consumption and Equipment Efficiencies - Current Building Stock

Table D: Commercial Space Conditioning Energy Consumption by Envelope Component
D1 - Current Building Stock
D2 - Ten Years of post-2000 New Construction

Table E: Conversion Factors

Example 1. Electric Water Heater

A newly proposed, advanced-technology, electric heat pump water heater (HPWH) is to be evaluated. From detailed engineering models, laboratory measured results, or field measured results, the performance over one year is established to be at 2.0 EF (Efficiency Factor). From market analysis, the maximum market penetration foreseen is 30% of the installed electric water heating stock. The penetration estimate accounts for fuel cost, first cost differential, number of homes with larger water heating requirements, and installation constraints. These two values are prepared by the proposer and must have supporting logic and data included. Prepare these two values before starting the remaining steps.

Step 1: Insert the EF of the proposed HPWH into two of the boxes. Look up the typical efficiency of a new electric water heater in Table A (found as 0.88 EF) and insert into the middle box. Simple arithmetic provides the percent energy savings over the typical new unit as 56.0%.

$$\begin{array}{ccccc} \boxed{\text{Energy Factor of the Heat Pump Water Heater}} & - & \boxed{\text{Energy Factor of the Typical Installed Electric Water Heater}} & \div & \boxed{\text{Energy Factor of the Heat Pump Water Heater}} \times 100 = \boxed{\% \text{ Energy savings over Typical New Technology}} \\ \text{Proposer Provides} & & \text{Table A} & & \text{Proposer Provides} \\ \\ \boxed{2.0} & - & \boxed{0.88} & \div & \boxed{2.0} \times 100 = \boxed{56.0\%} \end{array}$$

Step 2: Look up the energy consumption of electric water heaters in the residential sector in Table A. The value is 1.18 quads.

Step 3: Provide the value of the potential market penetration, estimated by the proposer. The estimate provided is 30%.

Step 4: Place the above three values (56.0%, 1.18 quads, and 30%) into the provided boxes and multiply. The result is a national total energy savings of 0.20 quads.

$$\begin{array}{ccccc} \boxed{\% \text{ Energy savings over typical new technology}} & \times & \boxed{\text{National energy consumption for end-use category}} & \times & \boxed{\text{Maximum potential market penetration (\%)}} = \boxed{\text{National Total Energy Savings}} \\ \text{Proposer Provides} & & \text{Detailed Tables} & & \text{Proposer Provides} \\ \\ \boxed{56.0\%} & \times & \boxed{1.18 \text{ quads}} & \times & \boxed{30\%} = \boxed{0.20 \text{ quads}} \\ \text{Proposer Provides} & & \text{Table A} & & \text{Proposer Provides} \end{array}$$

Step 5: To obtain the related carbon savings for the 0.20 quads, look up in Table E the fuel-specific carbon emissions factor, in this case for electricity. The conversion value is 15.67 Kg/MMBtu (kilogram per million Btu). Insert the two values into the boxes, and multiply the energy savings by the conversion factor. The result is 3.13 million metric tonnes of carbon.

$$\begin{array}{rcccl}
 \boxed{\text{National Total Energy Savings}} & \times & \boxed{\text{Energy to Carbon Factor}} & = & \text{National Total Carbon Savings} \\
 & & \text{Table E} & & \\
 \\
 \boxed{0.20 \text{ quads}} & \times & \boxed{15.67 \text{ KgC/MMBtu}} & = & 3.13 \times 10^6 \text{ metric tons C} \\
 & & \text{Table E} & &
 \end{array}$$

Results: The values to cite from this analysis are an energy savings of 0.20 quads and a carbon savings of 3.13 million metric tonnes of carbon.

Example 2. Building Shell - Current Building Stock

A newly proposed, advanced-technology wall insulation for retrofit into residential homes is to be evaluated. In this case, only the heating season performance will be considered for energy savings. From detailed heat transfer analysis and/or laboratory tests, the thermal performance of the insulation is determined. From detailed building performance models, laboratory measured results, or field measured results, the performance over one year is established for the entire wall system with the advanced-technology retrofit wall insulation product installed. Additional modeling and/or measurements are performed to establish the performance level for the typical new product that would be installed in the house walls. The two performance levels of efficiency for the wall (and thus the percent energy savings) are determined by the proposer, with supporting justification.

From market analysis, the maximum market penetration foreseen is 10% of existing residential homes with the proposed new insulation product. The penetration estimate accounts for fuel cost, first cost differential, number of homes with larger space heating requirements, and installation constraints.

These two values (percent energy savings and potential market penetration) are prepared by the proposer and must have supporting logic, data, and analysis included. Prepare these two values before starting the remaining steps.

Step 1: From modeling and/or measurements for the (a) proposed product and for the (b) typical new product on the market, the proposer establishes that the proposed product will have an energy savings over the competitive product of 40%.

Step 2: Look up the energy consumption attributable to walls of residential homes in Table B.1. The value is 2.11 quads, which contains all fuels (gas, oil, and electricity) consumed for heating in residential buildings

Step 3: Provide the value of the potential market penetration, estimated by the proposer. The estimate provided is 10%.

Step 4: Place the above three values (40.0%, 2.11 quads, and 10%) into the provided boxes and multiply. The result is a national total energy savings of 0.084 quads.

% Energy savings over typical new technology	X	National energy consumption for end-use category	X	Maximum potential market penetration (%)	=	National Total Energy Savings
Proposer Provides		Detailed Tables		Proposer Provides		

40%	X	2.11 quads	X	10%	=	0.084 quads
Proposer Provides		Table B.1		Proposer Provides		

Step 5: To obtain the related carbon savings for the 0.084 quads, look up in Table E the generic carbon emissions factor, in this case for space heating in residential buildings. The conversion value is 15.35 Kg/MMBtu (kilogram per million Btu)¹. Insert the two values into the boxes, and multiply the energy savings by the conversion factor. The result is 1.29 million metric tonnes of carbon.

National Total Energy Savings	X	Energy to Carbon factor	=	National Total Carbon Savings
		Table E		

0.084 quads	X	15.35 KgC/MMBtu	=	1.29 x 10 ⁶ metric tons of C
		Table E		

Results: The values to cite from this analysis are an energy savings of 0.084 quads and a carbon savings of 1.29 million metric tonnes of carbon.

Input Tables

Table A: Residential End-Use Primary Energy Consumption and Equipment Efficiencies - Current Building Stock

Type	Total Energy Use (quads) ²	Typical New Efficiency ³	Maximum Efficiency ⁴
Heating Equipment			
Gas Furnaces ⁵	2.79	80 AFUE	150 SCOP ⁶
Oil Furnaces	0.35	79 AFUE	96 AFUE
Gas Boilers	0.64	81 AFUE	150 SCOP
Oil Boilers	0.42	79 AFUE	96 AFUE
Electric Heat Pumps	0.45	7.5 HSPF	12 HSPF
Electric Furnaces, built-in Units	0.98	100 %	100 %
Other Electric	0.10	100 %	100 %
Other Gas ⁷	0.67		
Market Renewables (wood)	0.61		
Other Fuels	0.13		
Furnace Fans	0.38		
<i>Total Space Heating</i>	<i>7.52</i>		
Cooling Equipment			
Central A/C	0.83	10 SEER	20 SEER
Room A/C	0.32	9 EER	13 EER
Electric Heat Pump	0.35	10 SEER	20 SEER
Dehumidifier	0.12	972 kWh/year	500 kWh/year
<i>Total Space Cooling</i>	<i>1.62</i>		
Thermal Distribution - Heating⁸			
Warm Air Ducts	4.57	65%	100%
Hydronic System	1.06	85%	100%
Spot/Space in Room	1.89	100%	100%
<i>Total Space Heating</i>	<i>7.52</i>		
Thermal Distribution - Cooling⁹			
Warm Air Ducts	1.18	65%	100%
Spot/Space in Room	0.44	100%	100%
<i>Total Space Cooling</i>	<i>1.62</i>		

Type	Total Energy Use (quads) ²	Typical New Efficiency ³	Maximum Efficiency ⁴
Water Heating			
Electric	1.18	0.88 EF	3.0 EF
Gas	1.39	0.56 EF	1.4 EF
Oil	0.09	0.51 EF	0.86 EF
<i>Total Water Heating</i>	<i>2.66</i>		
Refrigeration			
Refrigerator	1.32	504 kWh ¹⁰	300 kWh
Freezer	0.42	475 kWh	350 kWh
<i>Total Refrigeration</i>	<i>1.74</i>		
Lighting			
Incandescent	0.81	15 LPW	150 LPW
Fluorescent	0.11	70 LPW	150 LPW
Other	0.17		
<i>Total Lighting</i>	<i>1.09</i>		
Ventilation	NA	NA	NA
Laundry			
Clothes Washer	0.78 ¹¹	0.82 MEF ¹²	1.6 MEF ¹³
Clothes Dryer (gas)	0.05	2.67 lbs/kWh	2.8 lbs/kWh
Clothes Dryer (electric)	0.62	3.01 lbs/kWh	4.0 lbs/kWh
<i>Total Laundry</i>	<i>0.76</i>		
Home Electronics			
Television	0.330	NA	
Video Cassette Recorder	0.096	NA	
Personal Computer	0.03	NA	
Other Electronics	0.414	NA	
<i>Total Home Electronics</i>	<i>0.87</i>		
Small Appliances			
Motors ¹⁴	0.18	NA	
Miscellaneous Heating ¹⁵	0.31	NA	
<i>Total Small Appliances</i>	<i>0.49</i>		

Type	Total Energy Use (quads) ²	Typical New Efficiency ³	Maximum Efficiency ⁴
Dishwasher			
Dishwasher	0.35 ¹⁶	0.50 EF	0.71 EF
Cooking			
Electric	0.43	0.77 EF	0.78 EF
Gas	0.16	0.40 EF	0.75 EF
LPG	0.03	0.40 EF	0.75 EF
<i>Total Cooking</i>	<i>0.62</i>		

Table B: Residential Space Conditioning Energy Consumption by Envelope Component

B.1 Current Building Stock

Component	Total Energy Use (quads)		Efficiency
	Heating	Cooling	Not Available See Example #2
Walls	2.11	0.16	
Roofs	1.20	0.20	
Windows (net)	0.30	0.43	
Conduction	[+1.45]	[+0.01]	
Solar	[-1.15]	[+0.42]	
Foundations	1.50	0	
Infiltration	2.41	0.21	
<i>Envelope Subtotal</i>	<i>7.52</i>	<i>1.00</i>	
Internal Loads	- -	0.50	
Total	<i>7.52</i>	<i>1.50</i>	

B.2 Ten Years of Post-2000 - New Construction¹⁷

Component	Total Energy Use (quads)		Efficiency
	Heating	Cooling	Not Available See Example #2
Walls	0.23	0.05	
Roofs	0.13	0.06	
Windows (net)	0.03	0.12	
Conduction	[+0.15]	[+0.01]	
Solar	[-0.12]	[+0.11]	
Foundations	0.16	0	
Infiltration	0.26	0.06	
<i>Envelope Subtotal</i>	<i>0.81</i>	<i>0.29</i>	
Internal Loads	--	0.14	
Total	<i>0.81</i>	<i>0.43</i>	

Table C: Commercial End-Use Primary Energy Consumption and Equipment Efficiencies- Current Building Stock

Type	Total Energy Use (quads) ¹⁸	Typical New Efficiency ¹⁹	Maximum Efficiency ²⁰
Heating Equipment			
Gas Furnaces	0.93	80 AFUE	150 SCOP
Oil Furnaces	0.11	80 AFUE	94 AFUE
Gas Boilers	0.32	81 AFUE	150 SCOP
Oil Boilers	0.09	83 AFUE	90 AFUE
Electric Heat Pumps	0.10	3.5 COP	4.7 COP
Electric Space Heaters	0.17	100 %	100 %
Other Electric	0.11		
Other Gas	0.09		
<i>Total Space Heating</i>	<i>1.92</i>		
Cooling Equipment			
Centrifugal Chillers	0.29	0.60 kW/ton	0.48 kW/ton
Reciprocating Chillers	0.32	1.10 kW/ton	0.90 kW/ton
Absorption Chillers	0.02	1.00 COP	1.60 COP
Rooftop A/C/ Unitary A/C	1.03	1.4 kW/ton	0.98 kW/ton
<i>Total Space Cooling</i>	<i>1.66</i>		
HVAC Auxiliary Equipment			
Supply and Return Fans	0.75	55% ²¹	65%
Exhaust Fans	0.50	45%	55%
Condenser Fans	0.075	45%	55%
Fan Power Terminal Boxes	0.03	30%	45%
Cooling Tower Fans	0.01	55%	65%
Heating Water Pumps	0.075	65%	75%
Condenser Water Pumps	0.03	70%	80%
Chilled Water Pumps	0.03	70%	80%
<i>Total Auxiliary Equipment</i>	<i>1.50</i>		

Type	Total Energy Use (quads) ¹⁸	Typical New Efficiency ¹⁹	Maximum Efficiency ²⁰
Water Heating			
Electric	0.55	98 %	300 %
Gas	0.45	80 %	150 %
Oil	0.05	80 %	94 %
Other Fuels	0.01		
<i>Total Water Heating</i>	<i>1.06</i>		
Refrigeration			
Supermarket- central system	0.33	35.5 kWh/year-ft ²	26.7 kWh/year-ft ²
Walk-in	0.18	18,800	12,700
Vending Machines	0.13	3,000	1,740
Beverage Merchandisers	0.05	5,900	2,650
Reach-in Freezer	0.066	4,900	2,700
Reach-in Refrigerator	0.054	3,800	2,100
Ice Machines	0.10	5,000	4,100
<i>Total Refrigeration</i>	<i>0.91</i>		
Lighting			
Incandescent	0.49	15 LPW	150 LPW
Fluorescent	2.50	75 LPW	150 LPW
HID	0.74	90 LPW	150 LPW
<i>Total Lighting</i>	<i>3.73</i>		
Office Equipment			
Office Equipment	0.84	NA	NA
Laundry²²			
Clothes Washer	0.054	1.0	1.87
Clothes Dryer	0.136	1.0	1.45
Gas	[0.122]		
Electric	[0.014]		
<i>Total Laundry</i>	<i>0.19</i>		

Type	Total Energy Use (quads) ¹⁸	Typical New Efficiency ¹⁹	Maximum Efficiency ²⁰
Cooking			
Electric	0.10	60 % EFF	85 % EFF
Gas	0.18	40 % EFF	75 % EFF
<i>Total Cooking</i>	<i>0.28</i>		

Table D: Commercial Space Conditioning Energy Consumption by Envelope Component²³

D.1 Current Building Stock

Component	Total Energy Use (quads)			Efficiency
	Heating	Cooling	Vent	
Walls	0.60	0		Not Available See Example #2
Roofs	0.33	0.02		
Windows (net)	0.25	0.45		
Conduction	[+0.60]	[-0.14]		
Solar	[-0.35]	[+0.59]		
Foundations	0.20	0		
Infiltration	0.54	0		
<i>Envelope Subtotal</i>	<i>1.92</i>	<i>0.47</i>		
Internal Loads	--	1.19		
Total	<i>1.92</i>	<i>1.66</i>	<i>0.54</i>	

D.2 Ten Years of Post-2000 - New Construction²⁴

Component	Total Energy Use (quads)			Efficiency
	Heating	Cooling	Vent	
Walls	0.06	0		Not Available See Example #2
Roofs	0.03	0.01		
Windows (net)	0.03	0.05		
Conduction	[+0.07]	[-0.02]		
Solar	[-0.04]	[+0.07]		
Foundations	0.02	0		
Infiltration	0.05	0		
<i>Envelope Subtotal</i>	<i>0.19</i>	<i>0.06</i>		
Internal Loads	--	0.14		
Total	<i>0.19</i>	<i>0.20</i>	<i>0.081</i>	

Table E: Conversion Factors

Item	Value	Units
Residential Gas Price (1997)	6.80	\$/MMBtu
Commercial Gas Price (1997)	5.62	\$/MMBtu
Residential Oil Price (1997)	7.00	\$/MMBtu
Commercial Oil Price (1997)	5.46	\$/MMBtu
Residential Electricity Price (1997)	0.085	\$/kWh
Commercial Electricity Price (1997)	0.076	\$/kWh
Fuel Specific Carbon Emission Factors		
Electricity	15.67	Kg/MMBtu
Gas	14.40	Kg/MMBtu
Oil	19.75	Kg/MMBtu
Generic Carbon Emission Factors		
Residential Buildings - Space Heating	15.35	Kg/MMBtu
Commercial Buildings - Space Heating	15.19	Kg/MMBtu
Average delivered Utility Power	11,045	Btu/kW

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Selected Sources of Additional Information:

Thermal Distribution Inefficiencies:

Neme, Chris, et al. *Energy Savings Potential From Addressing Residential Air Conditioning and Heat Pump Installation Problems*. American Council for an Energy-Efficient Economy. Report #A992. February 1999.

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Endnotes

1. Note: If energy savings were from space cooling, the fuel consumption is assumed to be all electricity, and look up the fuel specific carbon emission factor for electricity in Table E as 15.67 Kg/MMBtu.
2. Primary energy consumption that accounts for the generation, transmission, and distribution losses.
3. Efficiency as measured at the site.
4. **“Maximum Efficiency”** - estimate of potential efficiency level (as measured at the site) for future technologies, as a guideline.
5. Gas HVAC equipment includes LPG
6. SCOP - Seasonal Coefficient of Performance - efficiency level achievable by a gas-fired heat pump.
7. Other Gas includes 0.03 quads from Oil.
8. Energy consumption for Thermal Distribution is the same as for Heating Equipment (at 7.52 Quads), thus caution is needed to not double count the energy savings when evaluating improvements to the full system (heating equipment and thermal distribution). In full system cases, calculate (as in Example 1) the energy savings by the heating equipment. Subtract this energy savings from the listed table value of “Total Energy Use” in the Thermal Distribution section. Use this adjusted value to perform the energy savings estimate (similar to Example 1) for the improvements to the thermal distribution. Sum the two estimates of energy savings to obtain the estimate for the full system.
9. Energy consumption for Thermal Distribution is the same as for Space Cooling Equipment (at 1.62 Quads), thus caution is needed to not double count the energy savings when evaluating improvements to the full system (space cooling equipment and thermal distribution as in “warm-air ducts”). In full system cases, calculate (as in Example 1) the energy savings by the space cooling equipment. Subtract this energy savings from the listed table value of “Total Energy Use” in the Thermal Distribution section for “warm-air ducts”. Use this adjusted value to perform the energy savings estimate (similar to Example 1) for the improvements to the thermal distribution. Sum the two estimates of

energy savings to obtain the estimate for the full system.

10. Consumption relative to DOE standard that will take effect in July 2001.
11. The 0.78 quads includes 0.09 quads for electricity at the washer, and 0.69 quads for water heating.
12. MEF is based on DOE test procedure, Appendix J1.
13. MEF is based on DOE test procedure, Appendix J1.
14. Household motor driven equipment such as pool pumps, well pumps, garbage disposals, and food processors.
15. Household spot heating equipment such as clothes irons, electric blankets, and heat tapes.
16. The 0.35 quads includes 0.15 quads for electricity at the dishwasher, and 0.20 quads for water heating.
17. Assumes: Ten years of new construction @ 1,585,000 new homes per year. New home HVAC energy consumption typical of early 1990's buildings.
18. Primary energy consumption that accounts for the generation, transmission, and distribution losses.
19. Efficiency as measured at the site.
20. **“Maximum Efficiency”** - estimate of potential efficiency level (as measured at the site) for future technologies, as a guideline.
21. Includes effects of pump/fan, mechanical drive, and motor losses.
22. Estimate of potential efficiency levels are indexed.
23. NOTE: The energy consumption data in Table D represent national totals for all building types in all regions. These gains and losses vary considerably by region and building type. The data in Table D represent the net effect on HVAC system energy consumption. In some cases, the cooling energy use on an annual basis is zero, although for individual buildings, this may not be the case. Technologies can be developed that will independently affect either envelope heat gains or losses or that will be applied regionally. Since these effects cannot be captured with the above data, the analyst will have to develop detailed loss data to document potential energy savings. Detailed gain/loss data are included in the table for windows.
24. Assumes: Ten years of new construction @ 7.75 million square feet per year and HVAC energy consumption typical of early 1990's buildings.